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Guidance for the Reregistration of Pesticide Products Containing Hexazinone as the Active Ingredient

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Pesticides

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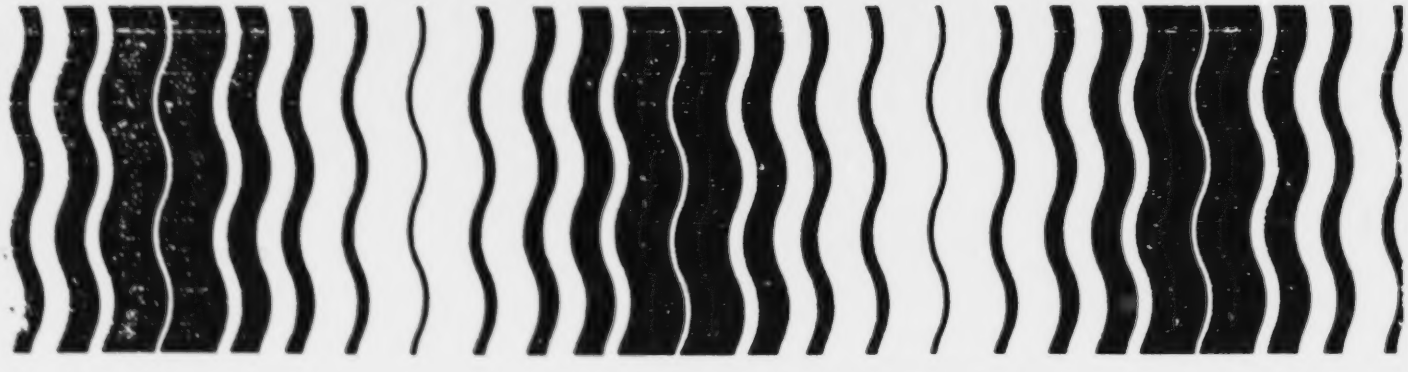
Hexazinone

(3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4(1H, 3H)-dione)

Pesticide Registration Standard



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This document contains information regarding the reregistration of pesticide products containing the subject active ingredient. The document includes how to register under a registration standard, regulatory position and rationale, and summaries of data requirements and data gaps. Also included is a bibliography containing citations of all studies reviewed by EPA in arriving at the positions and conclusions contained in the standard.

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HEXAZINONE (VELPAR^{R})

Pesticide Registration Standard

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Chapter One
HOW TO REGISTER UNDER A REGISTRATION STANDARD

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B. Purpose of the Standard
C. Requirement to Reregister Under the Standard
D. "Product Specific" Data and "Generic" Data
E. Data Compensation Requirements under FIFRA 3(c)(1)(D)
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A. Organization of the Standard

This first chapter explains the purpose of a Registration Standard and summarizes the legal principles involved in registering or reregistering under a Standard. The second chapter involves the regulatory position and the rationale supporting this position. The third chapter sets forth the data requirements that must be met to obtain or retain registration for products covered by this particular Registration Standard. In the remaining chapters, the Agency reviews the available data by scientific discipline, discusses the Agency's concerns with the identified potential hazards.

B. Purpose of the Standard

Section 3 of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) provides that "no person in any State may distribute, sell, offer for sale, hold for sale, ship, deliver for shipment, or receive (and having so received) deliver or offer to deliver, to any person any pesticide which is not registered with the Administrator [of EPA]." To approve the registration of a pesticide, the Administrator must find, pursuant to Section 3(c)(5) that:

> "(A) its composition is such as to warrant the proposed claims for it;
> (B) its labeling and other material required to be submitted comply with the requirements of this Act;
> (C) it will perform its intended function without unreasonable adverse effects on the environment; and
> (D) when used in accordance with widespread and commonly recognized practice it will not generally cause unreasonable adverse effects on the environment."

In making these findings, the Agency reviews a wide range of data which registrants are required to submit, and assesses the risks and benefits associated with the use of the

proposed pesticide. However, the established approach to making these findings has been found to be defective on two counts:

First, EPA and its predecessor agency, the United States Department of Agriculture (USDA), routinely reviewed registration applications on a "product by product" basis, evaluating each product-specific application somewhat independently. In the review of products containing similar components, there was little opportunity for a retrospective review of the full range of pertinent data available in Agency files and in the public literature. Thus the "product by product" approach was often inefficient and sometimes resulted in inconsistent or incomplete regulatory judgments.

Second, over the years, as a result of inevitable and continuing advances in scientific knowledge, methodology, and policy, the data base for many pesticides came to be considered inadequate by current scientific and regulatory standards. Given the long history of pesticide regulation in several agencies, it is even likely that materials may have been lost from the data files. When EPA issued new requirements for registration in 1975 (40 CFR 162) and proposed new guidelines for hazard testing in 1978 (43 FR 29686, July 10, 1978 and 43 FR 37336, August 22, 1978), many products that had already been registered for years were being sold and used without the same assurances of human and environmental safety as was being required for new products. Because of this inconsistency, Congress directed EPA to re-register all previously registered products, so as to bring their registrations and their data bases into compliance with current requirements [See FIFRA Section 3(g)].

Facing the enormous job of re-reviewing and calling-in new data for the approximately 35,000 current registrations, and realizing the inefficiencies of the "product by product" approach, the Agency decided that a new, more effective method of review was needed.

A new review procedure has been developed. Under it, EPA publishes documents called Registration Standards, each of which discusses a particular pesticide active ingredient. Each Registration Standard summarizes all the data available to the Agency on a particular active ingredient and its current uses, and sets forth the Agency's comprehensive position on the conditions and requirements for registration of all existing and future products which contain that active ingredient. These conditions and requirements, all of which must be met to obtain or retain full registration or reregistration under Section 3(c)(5) of FIFRA, include

the submission of needed scientific data which the Agency does not now have, compliance with standards of toxicity, composition, labeling, and packaging, and satisfaction of the data compensation provisions of FIFRA Section 3(c)(1)(D).

The Standard will also serve as a tool for product classification. As part of the registration of a pesticide product, EPA may classify each product for "general use" or "restricted use" [FIFRA Section 3(d)]. A pesticide is classified for "restricted use" when some special regulatory restriction is needed to ensure against unreasonable adverse effects to man or the environment. Many such risks of unreasonable adverse effects can be lessened if expressly-designed label precautions are strictly followed. Thus, the special regulatory restriction for a "restricted use" pesticide is usually a requirement that it be applied only by, or under the supervision of, an applicator who has been certified by the State or Federal government as being competent to use pesticides safely, responsibly, and in accordance with label directions. A restricted-use pesticide can have other regulatory restrictions [40 CFR 162.11(c)(5)] instead of, or in addition to, the certified applicator requirement. These other regulatory restrictions may include such actions as seasonal or regional limitations on use, or a requirement for the monitoring of residue levels after use. A pesticide classified for "general use," or not classified at all, is available for use by any individual who is in compliance with State or local regulations. The Registration Standard review compares information about potential adverse effects of specific uses of the pesticide with risk criteria listed in 40 CFR 162.11(c), and thereby determines whether a product needs to be classified for "restricted use." If the Standard does classify a pesticide for "restricted use," this determination is stated in the second chapter.

C. Requirement to Reregister Under the Standard

FIFRA Section 3(g), as amended in 1978, directs EPA to reregister all currently registered products as expeditiously as possible. Congress also agreed that reregistration should be accomplished by the use of Registration Standards.

Each registrant of a currently registered product to which this Standard applies, and who wishes to continue to sell or distribute his product in commerce, must apply for reregistration. His application must contain proposed labeling that complies with this Standard.

EPA will issue a notice of intent to cancel the registration of any currently registered product to which this Standard applies if the registrant fails to comply with the procedures for reregistration set forth in the Guidance Package which accompanies this Standard.

D. "Product Specific" Data and "Generic" Data

In the course of developing this Standard, EPA has determined the types of data needed for evaluation of the properties and effects of products to which the Standard applies, in the disciplinary areas of Product Chemistry, Environmental Fate, Toxicology, Residue Chemistry, and Ecological Effects. These determinations are based primarily on the data Guidelines proposed in 43 FR 29696, July 10, 1978; 43 FR 37336, August 22, 1978; and 45 FR 72948, November 3, 1980, as applied to the use patterns of the products to which this Standard applies. Where it appeared that data from a normally applicable Guidelines requirement was actually unnecessary to evaluate these products, the Standard indicates that the requirement has been waived. On the other hand, in some cases studies not required by the Guidelines may be needed because of the particular composition or use pattern of products the Standard covers; if so, the Standard explains the Agency's reasoning. Data guidelines have not yet been proposed for the Residue Chemistry discipline, but the requirements for such data have been in effect for some time and are, the Agency believes, relatively familiar to registrants. Data which we have found are needed to evaluate the registrability of some products covered by the Standard may not be needed for the evaluation of other products, depending upon the composition, formulation type, and intended uses of the product in question. The Standard states which data requirements apply to which product categories. (See the third chapter). The various kinds of data normally required for registration of a pesticide product can be divided into two basic groups:

1. Data that are product specific, i.e. data that relates only to the properties or effects of a product with a particular composition (or a group of products with closely similar composition); and

2. Generic data that pertain to the properties or effects of a particular ingredient, and thus is relevant to an evaluation of risks and benefits of all products containing that ingredient (or all such products having a certain use pattern), regardless of any such product's unique composition.

The Agency requires certain "product specific" data for each product to characterize the product's particular composition and physical/chemical properties (Product Chemistry), and to characterize the product's acute toxicity (which is a function of its total composition). The applicant for registration or reregistration of any product, whether it is a manufacturing-

use or end-use product, and without regard to its intended use pattern, must submit or cite enough of this kind of data to allow EPA to evaluate the product. For such purposes, "product specific" data on any product other than the applicant's is irrelevant, unless the other product is closely similar in composition to the applicant's. (Where it has been found practicable to group similar products for purposes of evaluating, with a single set of tests, all products in the group, the Standard so indicates). "Product specific" data on the efficacy of particular end-use products is also required where the exact formulation may affect efficacy and where failure of efficacy could cause public health problems.

All other data needed to evaluate pesticide products concerns the properties or effects of a particular ingredient of products (normally a pesticidally active ingredient, but in some cases a pesticidally inactive, "inert," ingredient). Some data in this "generic" category are required to evaluate the properties and effects of all products containing that ingredient [e.g., the acute LD_{50} of the active ingredient in its technical or purer grade; see proposed 40 CFR 163.81-1(a), 43 FR 37355].

Other "generic" data are required to evaluate all products which both contain a particular ingredient and are intended for certain uses (see, e.g., proposed 40 CFR 163.82-1, 43 FR 37363, which requires subchronic oral testing of the active ingredient with respect to certain use patterns only). Where a particular data requirement is use-pattern dependent, it will apply to each end-use product which is to be labeled for that use pattern (except where such end-use product is formulated from a registered manufacturing-use product permitting such formulations) and to each manufacturing-use product with labeling that allows it to be used to make end-use products with that use pattern. Thus, for example, a subchronic oral dosing study is needed to evaluate the safety of any manufacturing-use product that legally could be used to make an end-use, food-crop pesticide. But if an end-use product's label specified it was for use only in ways that involved no food/feed exposure and no repeated human exposure, the subchronic oral dosing study would not be required to evaluate the product's safety; and if a manufacturing-use product's label states that the product is for use only in making end-use products not involving food/feed use or repeated human exposure, the subchronic oral study would not be relevant to the evaluation of the manufacturing-use product either.

If a registrant of a currently registered manufacturing-use or end-use product wishes to avoid the costs of data compensation [under FIFRA Section 3(c)(1)(D)] or data generation [under Section 3(c)(2)(B)] for "generic" data that is required only with respect to some use patterns, he may elect to delete those use patterns from his labeling at the time he re-registers his product. An applicant for registration of a new product under this Standard may similarly request approval of only certain use patterns.

E. Data Compensation Requirements under FIFRA 3(c)(1)(D)

Under FIFRA Section 3(c)(1)(D), an applicant for registration, reregistration, or amended registration must offer to pay compensation for certain existing data the Agency has used in developing the Registration Standard. The data for which compensation must be offered is all data which is described by all the following criteria:

(1) The data were first submitted to EPA (or to its predecessor agencies, USDA or FDA), on or after January 1, 1970;

(2) The data were submitted to EPA (or USDA or FDA) by some other applicant or registrant in support of an application for an experimental use permit, an amendment adding a new use to a registration, or for reregistration, or to support or maintain in effect an existing registration;

(3) They are the kind of data which are relevant to the Agency's decision to register or reregister the applicant's product under the Registration Standard, taking into account the applicant's product's composition and intended use pattern(s);

(4) The Agency has found the data to be valid and usable in reaching regulatory conclusions; and

(5) They are not data for which the applicant has been exempted by FIFRA Section 3(c)(2)(D) from the duty to offer to pay compensation. (This exemption applies to the "generic" data concerning the safety of an active ingredient of the applicant's product, not to "product specific" data. The exemption is available only to applicants whose product is labeled for end-uses for which the active ingredient in question is present in the applicant's product because of his use of another registered product containing that active ingredient which he purchases from another producer).

An applicant for reregistration of an already registered product under this Standard, or for registration of a new product under this Standard, accordingly must determine which of the data used by EPA in developing the Standard must be the subject of an offer to pay compensation, and must submit with his application the appropriate statements evidencing his compliance with FIFRA Section 3(c)(1)(D).

An applicant would never be required to offer to pay for "product specific" data submitted by another firm. In many, if not in most cases, data which are specific to another firm's product will not suffice to allow EPA to evaluate the applicant's product, that is, will not be useful to the Agency in determining whether the applicant's product is registrable. There may be cases, however, where because of close similarities between the composition of two or more products, another firm's data may suffice to allow EPA to evaluate some or all of the "product specific" aspects of the applicant's product. In such a case, the applicant may choose to cite that data instead of submitting data from tests on his own product, and if he chooses that option, he would have to comply with the offer-to-pay requirements of Section 3(C)(1)(D)for that data.

Each applicant for registration or reregistration of a manufacturing-use product, and each applicant for registration or reregistration of an end-use product, who is not exempted by FIFRA Section 3(c)(2)(D), must comply with the Section 3(c)(1)(D) requirements with respect to each item of "generic" data that relates to his product's intended uses.

A detailed description of the procedures an applicant must follow in applying for reregistration (or new registration) under this Standard is found in the Guidance Package for this Standard.

F. Obtaining Data to Fill "Data Gaps"; FIFRA 3(c)(2)(B)

Some of the kinds of data EPA needs for its evaluation of the properties and effects of products to which this Standard applies have never been submitted to the Agency (or, if submitted, have been found to have deficiencies rendering them inadequate for making registrability decisions) and have not been located in the published literature search that EPA conducted as part of preparing this Standard. Such instances of missing but required data are referred to in the Standard as "data gaps".

FIFRA Section 3(c)(2)(B), added to FIFRA by the Congress in 1978, authorizes EPA to require registrants to whom a data requirement applies to generate (or otherwise produce)

data to fill such "gaps" and submit those data to EPA. EPA must allow a reasonably sufficient period for this to be accomplished. If a registrant fails to take appropriate and timely steps to fill the data gaps identified by a section 3(c)(2)(B) order, his product's registration may be suspended until the data is submitted. A mechanism is provided whereby two or more registrants may agree to share in the costs of producing data for which they are both responsible.

The Standard lists, in the third chapter, the "generic" data gaps and notes the classes of products to which these data gaps pertain. The Standard also points out that to be registrable under the Standard, a product must be supported by certain required "product specific" data. In some cases, the Agency may possess sufficient "product specific" data on one currently registered product, but may lack such data on another. Only those Standards which apply to a very small number of currently registered products will attempt to state definitively the "product specific" data gaps on a "product by product" basis. (Although the Standard will in some cases note which data that EPA does possess would suffice to satisfy certain "product specific" data requirements for a category of products with closely similar composition characteristics.)

As part of the process of reregistering currently registered products, EPA will issue Section 3(c)(2)(B) directives requiring the registrants to take appropriate steps to fill all identified data gaps -- whether that data in question is "product specific" or "generic" -- in accordance with a schedule.

Persons who wish to obtain registrations for new products under this Standard will be required to submit (or cite) sufficient "product specific" data before their applications are approved. Upon registration, they will be required under Section 3(c)(2)(B) to take appropriate steps to submit data needed to fill "generic" data gaps. (We expect they will respond to this requirement by entering into cost-sharing agreements with other registrants who previously have been told they must furnish the data.) The Guidance Package for this Standard details the steps that must be taken by registrants to comply with Section 3(c)(2)(B).

Registrants are reminded that Section 6(a)(2) of FIFRA requires you <u>at any time</u> to submit factual information raising concerns of possible unreasonable adverse effects of a pesticide. You should notify the Agency of interim results of studies in progress if those results show possible adverse effects.

G. Amendments to the Standard

Applications for registration which propose uses or formulations that are not presently covered by the Standard, or which present product compositions, product chemistry data, hazard data, toxicity levels, or labeling that do not meet the requirements of the Standard, will automatically be considered by the Agency to be requests for amendments to the Standard. In response to such applications, the Agency may request additional data to support the proposed amendment to the Standard, or may deny the application for registration on the grounds that the proposed product would cause unreasonable adverse effects to the environment. In the former case, when additional data have been satisfactorily supplied, and providing that the data do not indicate the potential for unreasonable adverse effects, the Agency will than amend the Standard to cover the new registration.

Each Registration Standard is based upon all data and information available to the Agency's reviewers on a particular date prior to the publication date. This "cut-off" date is stated at the beginning of the second chapter. Any subsequent data submissions and any approved amendments will be incorporated into the Registration Standard by means of addenda, which are available for inspection at EPA in Washington, D.C., or copies of which may be requested from the Agency. When all the present "data gaps" have been filled and the submitted data have been reviewed, the Agency will revise the Registration Standard. Thereafter, when the Agency determines that the internally maintained addenda have significantly altered the conditions for registration under the Standard, the document will be updated and re-issued.

While the Registration Standard discusses only the uses and hazards of products containing the designated active ingredient(s), the Agency is also concerned with the potential hazards of some inert ingredients and impurities. Independent of the development of any one Standard, the Agency has initiated the evaluation of some inert pesticide ingredients. Where the Agency has identified inert ingredients of concern in a specific product to which the Standard applies, these ingredients will be pointed out in the Guidance Package.

Chapter Two

Regulatory Position

A. Introduction

This chapter describes in detail the Agency's regulatory position on products which contain hexazinone as the sole active ingredient. The regulatory position adopted by the Agency incorporates a number of considerations. Foremost among these considerations is an analysis of the registrability of products containing hexazinone based on the risk criteria found in Section 162.11(a) of Title 40 of the U.S. Code of Federal Regulations. The Agency's determination is presented below, and the rationale for this decision follows the position.

In addition to the basic regulatory decision and rationale, this chapter includes the following: criteria for the registration of hexazinone products under the Standard; acceptable ranges and limits for product composition, acute toxicity, and use pattern/application method; required labeling; tolerance assessment.

The scientific basis for a decision presented in this chapter can be found by reading the various disciplinary chapters (Chapters IV - VIII) which provide summaries of available scientific data on hexazinone. References to Agency guidelines for testing are provided when appropriate. In instances where the data requirements differ from the guideline requirements, the rationale is presented in the footnotes of the table.

B. Description of Chemical

Hexazinone, 3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4(1H,3H)-dione, is a herbicide registered to control many annual, biennial and perennial weeds and woody plants in non-cropland areas, Christmas tree plantations, and reforestation areas. Hexazinone is also registered for use in sugarcane and alfalfa.

There is no currently registered manufacturing-use product. The end-use products that contain hexazinone as their single active ingredient are a 90% soluble powder, 60% dry flowable, 10 and 20% pellets, 0.48, 0.5 and 25% liquids. Hexazinone technical (97% A.I.) has been provisionally accepted for registration. E. I. DuPont de Nemours and Company, Inc. is the sole producer and registrant for all the formulations except for the 0.48 and 0.5% liquids. The 0.5% liquid is registered by R.H. Bogle Company, P.O. Box 588, Alexandria, VA 22313 and the 0.48% liquid by ACD Mobley Company, Inc., 3800 Stone Road, Kilgore Texas.

Hexazinone is the accepted common name for the chemical. It is also known under the trade or company names Velpar®, "DPX-3674" and "INA-3674". The Chemical Abstracts Registry (CAS) number for hexazinone is 51235-04-2 and the EPA Shaughnessy number is 107201.

C. Regulatory Position for Products Containing Hexazinone

Hexazinone as described in this Standard may be registered for sale, distribution, reformulation, and use in the United States. In preparing this Standard, The Agency has considered the scientific data obtained from the open literature and provided by the registrant as of November 30, 1981 (excluding residue data for pending tolerances). Based on the review of these data, the Agency finds that hexazinone has neither met or exceeded any of the risk criteria found in Section 162.11(a) of Title 40 of the U.S. Code of Federal Regulations. Therefore, the Agency has determined that hexazinone does not cause unreasonable adverse effects to either man or the environment when used in accordance with prescribed label directions and precautions.

Currently registered end-use products containing hexazinone may be reregistered under this Standard. New end-use products may be registered for terrestrial noncrop, crop and forest use under this Standard, provided the proposed products meet acceptable standards of product composition, use and toxicity.

Manufacturing-use products may also be registered under this Standard, provided the proposed product(s) meet acceptable standards of product composition, toxicity and use.

D. Regulatory Rationale

Proposed manufacturing-use products intended for reformulation into terrestrial noncrop, crop and forest use are acceptable under this Standard. The existing data base supports the registration of such products, provided that the proposed product has been determined to be the same as the hexazinone technical. Additional acute toxicity data and product chemistry information on the proposed manufacturing-use product would be required if the Agency determined that the proposed manufacturing-use product is not the same as the hexazinone technical.

Hexazinone was federally registered in November 1975 for general weed control in noncropland areas. Use in Christmas trees, reforestation areas and woody plants were added in 1977. State registrations under section 24(c) were proposed for use on sugarcane in 1978 and on alfalfa in 1979. These uses were accepted in 1980 and 81.

In 1978, Dupont proposed that the use pattern of the soluble powder end-use product (90% a.i. hexazinone) be changed from noncrop use to crop use for the control of established weeds in sugarcane and to classify the soluble powder product for general use.

EPA is authorized to conditionally amend the registration of a pesticide to permit additional uses under certain special circumstances [FIFRA Section 3(c)(7)(A)]. These include cases where the proposed usage conditions would not significantly increase the risk of any unreasonable adverse effect on man and/or the environment.

Hexazinone was conditionally registered for use on sugarcane (December 1980) and alfalfa (August 1981) with several conditions. These conditions included submission of data, i.e.:

Sugarcane and Alfalfa

a. submit and/or cite all data required for registration/ reregistration under FIFRA Section 3(c)(5)
b. submit production information for each fiscal year in which the use of sugarcane and alfalfa is conditionally registered (FIFRA Section 29)

Sugarcane

a. submit a mouse oncogenicity study
b. submit rat metabolism studies
c. submit information on the 21-day Daphnia life cycle test.

The Agency has evaluated data submitted on sugarcane items (b) and (c) and has found that the proposed usage of hexazinone will not cause unreasonable adverse effects on the environment. Item (a) was submitted July 30, 1981 and a further assessment of the effects of hexazinone on man and the environment from the current use pattern is being conducted.

An emergency exemption under Section 18 of FIFRA was granted (1979) to the State of Hawaii for the use of hexazinone (Velpar) for the control of vaseygrass and dallisgrass on pineapples. The 90% soluble powder was requested for pre- and postemergence weed control in pineapples. Temporary tolerance have been established for residues of hexazinone in or on the following raw agricultural commodities: pineapple (whole fruit) 0.2 ppm, pineapple forage 5 ppm, milk 0.05 ppm, meat, fat, and meat by-products (except liver) of cattle, goats, horses, hogs and sheep 0.05 ppm, liver of cattle, goats, horses, hogs and sheep 0.1 ppm.

E. Criteria for Registration Under the Standard

To be subject to this Standard, hexazinone products must meet the following conditions:

- contain hexazinone as the sole active ingredient;
- be within acceptable standards of product composition;
- be within acute toxicity limits;
- be labeled for acceptable uses; and
- bear required labeling.

Proposed manufacturing-use hexazinone products must bear label directions for formulation into acceptable end-uses.

The applicant for registration or reregistration of hexazinone products subject to the Standard must comply with all terms and conditions described in this Standard, including commitment to fill data gaps on a time schedule specified by the Agency, and when applicable, offer to pay compensation to the extent required by 3(c)(1)(D) and 3(c)(2)(D) of the Federal Insecticide, Fungicide, and Rodenticide Act [FIFRA]

F. Acceptable Ranges and Limits

1. Manufacturing-Use Hexazinone

a. Product Composition Standards

There is no currently registered manufacturing-use hexazinone product. Thus, there are no limits on product composition at this time. Data are required, however, on the physical and chemical properties of technical grade hexazinone to support the registration of end-use products.

b. Acute Toxicity Limits

The Agency will consider registration of proposed manufacturing-use hexazinone products which have established acute toxicity I-IV ratings for each of the following effects:

Acute Oral Toxicity
Acute Dermal Toxicity
Acute Inhalation Toxicity
Primary Eye Irritation
Primary Dermal Irritation

c. Use Patterns

To be covered under this Standard, proposed manufacturing-use hexazinone products must be labeled to allow for formulation into end-use herbicides which are intended for specific terrestrial forest, noncrop and crop-use applications.

2. End-Use Hexazinone - Soluble Powder (SP)

a. Product Composition

Soluble powder end-use hexazinone products with any percentage of active ingredient are acceptable under this Standard with appropriate certification of limits.

Inert ingredients in food-use formulations must be cleared for such use under 40 CFR 180.1001. The inert ingredients in the currently registered soluble powder end-use product are exempt according to 40 CFR 180.1001(c).

b. Acute Toxicity Limits

The Agency will consider registration of any soluble powder end-use hexazinone product under this Standard provided that it falls under acute toxicity categories acceptable for general use and bears appropriate precautionary labeling.

c. Use Patterns and Application Methods

To be registered under this Standard, soluble powder end-use products of hexazinone must be labeled as an herbicide for use on one or more of the following sites:

food uses	non-food uses
sugarcane	noncropland
alfalfa	christmas tree plantations
	reforestation areas

The Agency finds that current dosage rates and application methods are acceptable under this Standard. These rates are summarized in Chapter V.

3. End-Use Hexazinone Liquid, Pellet, Dry Flowable

a. Product Composition

The liquid, pellet and dry flowable end-use hexazinone products with any percentage of active ingredient are acceptable under this Standard with appropriate certification of limits.

Inert ingredients in the currently registered liquid, pellet and dry flowable end-use producs are cleared under 40 CFR 180.1001(c,e).

b. Acute Toxicity Limits

The Agency will consider registration of any end-use hexazinone product under this Standard provided that it falls under acute toxicity ratings (I-IV) acceptable for general use and bears appropriate precautionary labeling.

c. Use Patterns

To be registered under this Standard, liquid, pellet and dry flowable hexazinone end-use products may only be used on terrestrial noncropland, christmas tree plantations and reforestation areas.

The Agency finds that current dosage rates and application methods are acceptable under this Standard. These rates are summarized in Chapter V.

G. Required Labeling

1. Manufacturing-use Products

a. Use Pattern Statements

All proposed manufacturing-use hexazinone products must bear appropriate labeling as specified in 40 CFR 162.10.

2. End-Use Hexazinone Products

All end-use products containing hexazinone must display appropriate labeling as specified in 40 CFR 162.10. The guidance package contains specific information regarding label requirements.

a. Soluble Powder (SP)

Sugarcane

Because data on the effects of hexazinone in sugarcane forage were not submitted, a livestock feeding restriction, "Do not feed sugarcane forage to livestock", must be displayed on all labels proposing this use.

H. Tolerance Reassessment

Tolerances have been established for the combined residues of the herbicide hexazinone [3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4(1H,3H)-dione] and its metabolites

(calculated as hexazinone) (40 CFR 180.396) in or on the following raw agricultural commodities:

Alfalfa, green	2.0
Alfalfa, hay	8.0
Cattle, fat	0.1
Cattle, mbyp	0.1
Cattle, meat	0.1
Eggs	0.1
Goats, fat	0.1
Goats, mbyp	0.1
Goats, meat	0.1
Hogs, fat	0.1
Hogs, mbyp	0.1
Hogs, meat	0.1
Horses, fat	0.1
Horses, mbyp	0.1
Horses, meat	0.1
Milk	0.1
Poultry, fat	0.1
Poultry, mbyp	0.1
Poultry, meat	0.1
Sheep, fat	0.1
Sheep, mbyp	0.1
Sheep, meat	0.1
Sugarcane	0.2

The tolerances are supported by toxicology data. Based on a NOEL of 200 ppm in the 2 year rat feeding study, the provisional acceptable daily intake (PADI) is 0.0125 mg/kg/day with a maximum permissible intake (MPI) of 0.75 mg/day for a 60 kg person.

Based on the established tolerances the theoretical maximum residue contribution (TMRC) equates to 0.0788 mg/day/1.5 kg. The TMRC is approximately 10.50% of the MPI.

There is a pending tolerance for use of hexazinone on forage grasses. Because the TMRC is significantly less than the MPI, additional tolerances are acceptable.

No recommendation for maximum residue limits has been made for this chemical by the Codex Alimentarius Commission.

Tolerances have not been established in Mexico or in Canada for residues of hexazinone.

Chapter Three

Data Requirements and Data Gaps

A. MANUFACTURING-USE HEXAZINONE

Table A, entitled Generic Data Requirements, includes those data that pertain to the properties or effects of hexazinone as an active ingredient. Thus, these data are relevant to an evaluation of the risks and benefits of all products containing hexazinone. Providing data to fill indicated gaps is the primary responsibility of the manufacturing-use product registrant(s). Because there is no currently registered manufacturing-use hexazinone product, any needed data must be provided by the registrant of the registered end-use products to obtain reregistration. Registrants of end-use products which are not exempted by FIFRA Section 3(c)(2)(D) are also responsible for the submission of these data.

Table B, entitled Product-Specific Data Requirements for Manufacturing-Use Products, includes those data that are required for the registration of a proposed manufacturing-use product under this Standard (for terrestrial crop, noncrop and forest uses).

B. END-USE HEXAZINONE PRODUCTS

Table C, entitled Product Specific Data Requirements for End-Use Products, includes those data that relate only to the properties or effects of an end-use product with a specific composition. Thus, these data are required to support the registration(s) of each end-use product with a specific composition. Providing data to fill these requirements is the responsibility of each applicant for the registration of an end-use product.

Applicants for the registration of new end-use hexazinone products must submit all product-specific data or establish that the proposed product is substantially similar to another product for which the Agency has received acceptable product-specific data.

Table A
Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Product Chemistry						
163.61-3	Product Identity and Disclosure of Ingredients	Yes	Technical Grade	All	DuPont, 1973 MRID 0078058	No
163.61-4	Manufacturing Process	Yes	Technical Grade	All	DuPont, 1978 MRID 0078034	No
163.61-5	Formation of Unint. Ingredients	Yes	Technical Grade	All	DuPont, 1976 MRID 0078060	No
163.61-6	Declaration/Certification of Ingredient Limits	Yes	Technical Grade	All	DuPont, 1973 MRID 0078058	No
163.61-7	Product Analytical Methods & Data	Yes	Technical Grade	All	DuPont, 1973 MRID 0078058	No
163.61-8(1)	Color	Yes	Technical Grade	All	DuPont, 1973 MRID 0078058	No
163.61-8(2)	Odor	Yes	Technical Grade	All	DuPont, 1973 MRID 0078058	No

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table A
Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Product Chemistry						
163.61-8(3)	Melting Point	Yes	Technical Grade	All	DuPont, 1973 MRID 0078058	No
13.61-8(4)	Solubility	Yes	Technical Grade	All	DuPont, 1973 MRID 0078058	No
163.61-8(5)	Stability	Yes	Technical Grade	All	DuPont, 1973 MRID 0078058	No
163.61-8(6)	Octanol/water Partition coefficient	Yes	Technical Grade	No		Yes: 6 months
163.61-8(7)	Physical State	Yes	Technical Grade	All	DuPont, 1973 MRID 0078058	No
163.61-8(8)	Density or Specific Gravity	Yes	Technical Grade	All	DuPont, 1973 MRID 0078058	No
163.61-8(9)	Boiling Point	No				No[1]
163.61-8(10)	Vapor Pressure	Yes	Technical Grade	All	DuPont, 1973 MRID 0078058	No
163.61-8(11)	pH	Yes	Technical Grade	No		Yes: 6 months

[1] Not applicable to a solid.

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table A
Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Environmental Fate						
163.62-7(b)	Hydrolysis	Yes		Yes	Rhodes, 1975 MRID 0078037	No
163.62-7(c)	Photodegradation	Yes		Yes	Rhodes, 1975 MRID 007803	No
163.62-8(b)	Aerobic Soil Metabolism	Yes		Yes	Rhodes, 1975 MRID 0078037	No
163.62-8(c)	Anaerobic Soil Metabolism	Yes	Technical or radiolabeled analytical grade	No		Yes: 24 months[1]
163.62-8(d)	Anaerobic Aquatic Metabolism	Yes	Technical or radiolabeled analytical grade	No		Yes: 24 months[2]
163.62-8(e)	Aerobic Aquatic Metabolism	Yes	Technical or radiolabeled analytical grade	No		Yes: 24 months[3]
163.62-8(f)	Microbial Metabolism (2) effects of microbes on pesticides	Yes		Yes	Kraus, 1975 MRID 0078024	Reserved[4]
	(3) effects of pesticides on microbes	Yes		Yes	Williams, 1975 MRID 0078045	Reserved[4]

[1] Data are required to support all field/vegetable crop uses.
[2] Data are required to support aquatic non-crop uses such as drainage ditchbanks and forest uses.
[3] Data are required to support aquatic non-crop uses such as drainage ditchbanks.
[4] The requirement for the submission of data is currently being reserved pending the review and modification of the testing protocol. Consequently, the absence of acceptable data does not constitute a data gap.

Table A
Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Environmental Fate						
163.62-8(g)	Activated Sludge Metabolism	No				Reserved[1]
163.62-9(b)	Leaching	Yes		Yes	Rhodes, 1975 MRID 0078039	Yes: 12 months[2]
163.62-9(c)	Volatility	No				No
163.62-9(d)	Adsorption/ desorption	Yes	Technical or radio-labeled analytical grade	No		Yes: 12 months[3]
163.62-9(e)	Water dispersal	No				
163.62-10(b)	Terrestrial field dissipation					
	(1) Field & vegetable crop	Yes	A representative formulated product	No		Yes: 24 months
	(2) Tree fruit & nut crop uses	No				No
	(3) Pasture land uses	No				No
	(4) Domestic outdoor parks, ornamentals and turf uses	No				No

[1]The requirement for the submission of data is currently being reserved pending the review and modification of the testing protocols. Consequently, the absence of acceptable data does not constitute a data gap.
[2]An age-soil study is needed to support terrestrial crop and forest uses.
[3]Data are needed to support all of the uses currently registered.

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table A
Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Environmental Fate						
	(5) Rights of ways, shelterbelts and related uses	No				No
163.62-10(c)	Aquatic field dissipation					
	(1) Aquatic food	No				No
	(2) Aquatic noncrop uses	No				No
	(3) Specialized aquatic uses	No				No
163.62-10(d)	Terrestrial (forest) field dissipation	Yes	Formulated Products	Yes	DuPont, 1981 MRID 0078083	No
163.62-10(e)	Aquatic impact uses					
	(1) Direct discharge	No				No
	(2) Indirect discharge	No				No
	(3) Wastewater treatment	No				No

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table A
Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Environmental Fate						
163.62-10(f)	Combination and tank mix field dissipation	No				No
163.62-10(g)	Long term field dissipation study	No				No
163.62-11(b)	Accumulation in rotational crops	Yes	A representative formulated product	Yes	DuPont, 1980 MRID 0078089	No
163.62-11(c)	Accumulation in irrigated crops	No				
163.62-11(d)	Fish accumulation	Yes	Technical or radio-labeled analytical grade	Yes	Rhodes, 1975 MRID 0078032	No
163.62-11(e)	Special studies accumulation in aquatic noncrop uses	No				No
163.62-13	Disposal and storage	No				No

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table A
Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Toxicology						
163.81-1	Acute Oral Toxicity	Yes	Technical Grade	Yes	DuPont, 1973 MRID 0078007	No
163.81-2	Acute Dermal Toxicity	Yes	Technical Grade	Yes	DuPont, 1973 MRID 0078008	No
163.81-3	Acute Inhalation	Yes	Technical Grade	Yes	DuPont, 1973 MRID 0078005	No
163.81-4	Primary Eye Irritation	Yes	Technical Grade	Yes	DuPont, 1973 MRID 0078017	No
163.81-5	Primary Dermal Irritation	Yes	Technical Grade	Yes	DuPont, 1972 MRID 0078025	No
163.81-6	Dermal Sensitization	Yes	Technical Grade	Yes	DuPont, 1972 MRID 0078025	No
163.81-7	Acute Neurotoxicity	No		No		No

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table A
Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Toxicology						
163.82-1	Subchronic Oral Toxicity	Yes	Technical Grade	Yes	Sherman, 1973 MRID 0078043 MRID 0078004	No
163.82-2	Subchronic 21-Day Dermal Toxicity	No				No
163.82-3	Subchronic 90-Day Dermal Toxicity	No				No
163.82-4	Subchronic Inhalation Toxicity	No				No
163.82-5	Subchronic Neurotoxicity	No				No

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table A
Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Toxicology						
163.83-1	Chronic Feeding	Yes	Technical Grade	Yes	Kaplan, 1977 MRID 0078022	No
163.83-2	Oncogenicity	Yes	Technical Grade	Yes		No[1]
163.83-3	Teratogenicity	Yes	Technical Grade	Yes	DuPont, 1974 MRID 0078009 DuPont, 1980 MRID, 0078014	No
163.83-4	Reproduction	Yes	Technical Grade	Yes	DuPont, 1975 MRID 0078070	No
163.84-2 through -4	Mutagenicity	Yes	Technical Grade	Yes	DuPont, 1977 MRID 0078011	No
163.85-1	Metabolism	Yes	Technical Grade	No	DuPont, 1978 MRID 0078031	Yes: 12 months[2]

[1] An oncogenicity study in a second species (mice) was submitted July 31, 1981 and is currently under review.
[2] A rat metabolism study is required. Submitted data was inadequate to assess the effects of hexazinone.

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table A
Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Residue Chemistry						
—	Residues in Plants	Yes	Technical Grade	Yes	Rhodes, 1976 MRID 0078035 Rapisarda, 1979 MRID 0078030	No
—	Residues in Animals	Yes	Technical Grade	Yes	Rapisarda, 1978 MRID 0078031	No
—	Analytical Methods	Yes	Technical Grade	Yes	Holt, 1975 MRID 0078019	No
—	Residue Data: Sugarcane	Yes	Technical Grade	Yes	DuPont, 1976 MRID 0078010	No
—	Residue Data: Milk, Meat, and Eggs	Yes	Technical Grade	Yes	DuPont, 1979 MRID 0078078 DuPont, 1980 MRID 0078021	No
—	Residue Data Alfalfa	Yes	Technical Grade	Yes	DuPont, 1979 MRID 0078086	No

These data requirments are current as of December 1981.
Refer to guidance package for updated requirements.

Table A
Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Ecological Effects						
163.72-1	Fish Acute LC_{50}	Yes	Technical Grade	Yes	Sleight, 1973 MRID 0078056	No
163.72-2	Acute Toxicity to Aquatic Invertebrates	Yes	Technical Grade	Yes	Schneider, 1977 MRID 0078042	No
163.72-3	Acute Toxicity to Estaurine and Marine Organisms	Yes	Technical Grade	Yes	Heitmuller, 1976 MRID 0078018	No
163.72-4	Embryolarvae and Life-cycle Studies of Fish and Aquatic Invertebrates	Yes	Technical Grade	Yes	Schneider, 1976 MRID 0078041	No
163.72-5	Aquatic Organism Toxicity and Residue Studies	No				No
163.72-5	Simulated or Actual Field Testing for Aquatic Organisms	No				No

These data requirments are current as of December 1981.
Refer to guidance package for updated requirements.

Table A
Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Ecological Effects						
163.71-1	Avian Single-Dose Oral LD_{50}	Yes	Technical Grade	Yes	Fink, 1978 MRID 0078016	No
163.71-2	Avian Dietary LC_{50}	Yes	Technical Grade	Yes	Piccirillo, 1978 MRID 0078016 Dudeck, 1980 MRID 0078002	No
163.71-3	Mammalian Acute Toxicity	No				No
163.71-4	Avian Reproduction	No				No
163.71-5	Simulated and Actual Field Testig for Mammals and Birds	No				No

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table A
Generic Data Requirements

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Ecological Effects						
163.122-1	Seed Germination	Yes*	Technical	No		Reserved
163.122-1	Vegetative Vigor	Yes*	Technical	No		Reserved
163.122-2	Aquatic Macrophytes	Yes*	Technical	No		Reserved
163.122-2	Algae	Yes*	Technical	No		Reserved

*These data are not required until two years after promulgation of these guidelines.

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table B
Product-Specific Data Requirements for Manufacturing-Use Products

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Product Chemistry						
163.61-3	Product Identity and Disclosure of Ingredients	Yes	MUP			
163.61-4	Description of Manufacturing Process	Yes	MUP			
163.61-5	Discussion of Formation of Unint. Ingredients	Yes	MUP			
163.61-6	Declaration and Certification of Ingredient Limits	Yes	MUP			
163.61-7	Product Analytical Methods and Data	Yes	MUP			
163.8(1)	Color	Yes	MUP			
163.8(2)	Odor	Yes	MUP			
163.61-8(7)	Physical State	Yes	MUP			

[1]There is no registered manufacturing-use product. Additional data on product chemistry information would be required on proposed manufacturing-use products, if the Agency determined that the proposed manufacturing use-product is not the same as the hexazinone technical.

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table B
Product-Specific Data Requirements for Manufacturing -Use Product

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement[1]	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Product Chemistry						
163.61-8(8)	Density or Specific Gravity	Yes	MUP			
163.61-8(9)	Boiling Point	Yes	MUP			
163.61-8(11)	pH	Yes	MUP			
163.61-8(12)	Storage Stability	Yes	MUP			
163.61-8(13)	Flammability	Yes	MUP			
163.61-8(14)	Oxidizing or Reducing Action	Yes	MUP			
163.61-8(15)	Explosiveness	Yes	MUP			
163.61-8(16)	Miscibility	Yes	MUP			
163.61-8(17)	Viscosity	Yes	MUP			
163.61-8(18)	Corrosion Characteristics	Yes	MUP			

[1]There is no registered manufacturing-use product. Additional information on product chemistry would be required on proposed manufacturing-use products, if the Agency determined that the proposed manufacturing-use product is not the same as the hexazinone technical.

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table B
Product-Specific Data Requirements for Manufacturing-Use Products

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Toxicology						
163.81-1	Acute Oral Toxicity	Yes	MUP			
163.81-2	Acute Dermal Toxicity	Yes	MUP			
163.81-3	Acute Inhalation	Yes	MUP			
163.81-4	Primary Eye Irritation	Yes	MUP			
163.81-5	Primary Dermal Irritation	Yes	MUP			
163.81-6	Dermal Sensitization	Yes	MUP			

[1] There is no registered manufacturing-use product. Additional acute toxicity data would be required on proposed manufacturing-use products, if the Agency determined that the proposed manufacturing-use product is not the same as the hexazinone technical. Data have been submitted on the technical grade (a.i.). Data must be submitted at the time the application for registration is made.

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table C
Product-Specific Data Requirements for End-Use Products

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Product Chemistry						
163.61-3	Product Identity and Disclosure of Ingredients	Yes	Each Product	Yes	DuPont, MRID 00780058, 0078061, 0078065, 0078069	No
163.61-4	Description of Manufacturing Process	Yes	Each Product	Yes	DuPont, 1975 MRID 0078034 DuPont, 1978 MRID 0078061 DuPont, 1979 MRID 0078065	No
163.61-5	Discussion of Formation of Unint. Ingredients	Yes	Each Product	Partial	DuPont, 1977 MRID 0078090 DuPont 1978 MRID 0078062	Yes: 6 months[1]
163.61-6	Declaration and Certification of Ingredient Limits	Yes	Each Product	No		Yes

1/ These data requirements are required on the dry flowable and liquid end-use products. Data requirement on pellet and soluble end-use products are satisfied.

These data requirments are current as of December 1981.
Refer to guidance package for updated requirements.

Table C
Product-Specific Data Requirements for End-Use Products

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Product Chemistry						
163.61-7	Product Analytical Methods and Data	Yes	Each Product	Partial	DuPont, 1975 MRID 0078058 DuPont, 1978 MRID 0078061 DuPont, 1979 MRID 0078065	Yes: 6 months[1]
163.61-8(1)	Color	Yes	Each Product	No		Yes:6 months[4]
163.61-8(2)	Odor	Yes	Each Product	No		Yes: 6 months
163.61-8(7)	Physical State	Yes	Each Product	Yes	DuPont, 1980 MRID 0078067, 0078065, 0078061, 0078067, CSF*	No
163.61-8(8)	Density or Specific Gravity	Yes	Each Product	Partial	DuPont, 1980 MRID 0078067	Yes: 6 months[2]
163.61-8(9)	Boiling Point	Yes	Each Product	No		Yes: 6 months[3]

1/ Data required on dry flowable.
2/ Data requirement is required on the soluble powder. Dry flowable, liquid and pellet end-use products have been satisfied.
3/ Data are required on the liquid end-use product.
4/ Data requirement satisfied for soluble powder 90%.
* Confidential statement of formulation.

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table C
Product-Specific Data Requirements for End-Use Products

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Product Chemistry						
163.61-8(11)	pH	Yes	Each Product	No		Yes: 6 months[1]
163.61-8(12)	Storage Stability	Yes	Each Product	Yes	DuPont, 1978 MRID 0078061 DuPont, 1979 MRID 0078065 MRID 0078067	Yes: 6 months[2]
163.61-8(13)	Flammability	Yes	Each Product	Yes	DuPont, 1979 MRID 0078065	No
163.61-8(14)	Oxidizing or Reducing Action	Yes	Each Product	No		No
163.61-8(15)	Explosiveness	Yes	Each Product	No		Yes: 6 months[3]
163.61-8(16)	Miscibility	Yes	Each Product	No		Yes: 6 months[2/3]
163.61-8(17)	Viscosity	Yes	Each Product	No		Yes: 6 months[3]
163.61-8(18)	Corrosion Characteristics	Yes	Each Product	No		Yes: 6 months

[1] Data are required on all end-use products.
[2] Data required on soluble powder.
[3] Data are required on the 25% liquid formulation.

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table C
Product-Specific Data Requirements for End-Use Products

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Toxicology						
1. Dry Flowable (60%)						
163.81-1	Acute Oral Toxicity	Yes	Each Product[1]	Yes	DuPont, 1977 MRID 0078023	No
163.81-2	Acute Dermal Toxicity	Yes	Each Product[1]	No		Yes: 6 months
163.81-3	Acute Inhalation Toxicity	Yes	Each Product[1]	No		Yes: 6 months
163.81-4	Primary Eye Irritation	Yes	Each Product[1]	Yes	DuPont, 1978 MRID 0078015	No
163.81-5	Primary Dermal Irritation	Yes	Each Product[1]	Yes	DuPont, 1977 MRID 0078072	No
163.85-6	Dermal Sensitization	Yes	Each Product[1]	No		Yes: 6 months

[1]Each product or substantially similar product.

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table C
Product-Specific Data Requirements for End-Use Products

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Toxicology						
2. Liquid (25%)						
163.81-1	Acute Oral Toxicity	Yes	Each Product[1]	Partial	DuPont, 1976 MRID 0078048	No[2]
163.81-2	Acute Dermal Toxicity	Yes	Each Product[1]	Partial	DuPont, 1976 MRID 0078048	No[2]
163.81-3	Acute Inhalation Toxicity	Yes	Each Product[1]			No[2]
163.81-4	Primary Eye Irritation	Yes	Each Product[1]	Yes	DuPont, 1976 MRID 0078047	No
163.81-5	Primary Dermal Irritation	Yes	Each Product[1]		DuPont, 1976 MRID 0078073	No[2]
163.85-6	Dermal Sensitization	Yes	Each Product[1]		DuPont, 1976 MRID 0078050	No[2]

[1]Each product or substantially similar product.
[2]The uses for this product are essentially identical to the currently registered hexazinone end-use products (352, 378, 397, 388). Therefore, no additional data are required under section 3(c)(7) of FIFRA.

These data requirements are current as of December 1981. Refer to guidance package for updated requirements.

Table C
Product-Specific Data Requirements for End-Use Products

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Toxicology						
3. Pellet (10%)						
163.81-1	Acute Oral Toxicity	Yes	Each Product[1]	Yes	DuPont, 1980 MRID 0078109	No
163.81-2	Acute Dermal Toxicity	No	Each Product[1]			No[2]
163.81-3	Acute Inhalation Toxicity	No	Each Product[1]			No[2]
163.81-4	Primary Eye Irritation	No	Each Product[1]			No[2]
163.81-5	Primary Dermal Irritation	No	Each Product[1]			No[2]
163.85-6	Dermal Sensitization	No	Each Product[1]			No[2]

[1]Each product or substantially similar product.
[2]No additional toxicology data are required because of the shape and size of the formulation.

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table C
Product-Specific Data Requirements for End-Use Products

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Toxicology						
4. Soluble Powder (90%)						
163.81-1	Acute Oral Toxicity	Yes	Each Product[1]	Yes	DuPont, 1973 MRID 0078007	No
163.81-2	Acute Dermal Toxicity	Yes	Each Product[1]		DuPont, 1973 MRID 00798008	No
163.81-3	Acute Inhalation Toxicity	Yes	Each Product[1]	Yes	DuPont, 1973 MRID 0078005	No
163.81-4	Primary Eye Irritation	Yes	Each Product[1]	Yes	DuPont, 1973 MRID 0078017	No
163.81-5	Primary Dermal Irritation	Yes	Each Product[1]		DuPont, 1972 MRID 0078025	No
163.81-6	Dermal Sensitization	Yes	Each Product[1]		DuPont, 1972 MRID 0078025	No

[1]Each product or substantially similar product.

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table C
Product-Specific Data Requirements for End-Use Products

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Toxicology						
5. Liquid (0.5%)						
163.81-1	Acute Oral Toxicity	Yes	Each Product[1]	Yes	Bogle, 1981 MRID 0078093	No
163.81-2	Acute Dermal Toxicity	Yes	Each Product[1]	Yes	Bogle, 1981 MRID 0078094	No
163.81-3	Acute Inhalation Toxicity	Yes	Each Product[1]	Yes	Bogle, 1981 MRID 0078095	No
163.81-4	Primary Eye Irritation	Yes	Each Product[1]	Yes	Bogle, 1981 MRID 0078096	No
163.81-5	Primary Dermal Irritation	Yes	Each Product[1]	Yes	Bogle, 1981 MRID 0078097	No
163.85-6	Dermal Sensitization	No				No

These data requirements are current as of December 1981.
Refer to guidance package for updated requirements.

Table C
Product-Specific Data Requirements for End-Use Products

Guidelines Citation	Name of Test	Are Data Required	Composition	Does EPA Have Data to Partially or Totally Satisfy this Requirement	Bibliographic Citation	Must Additional Data be Submitted Under FIFRA 3(c)(2)(B)? If so, months allowed for submission from published date of standard
Toxicology						
6. Pellet (20%)						
163.81-1	Acute Oral Toxicity	Yes	Each Product[1]	Yes	DuPont, 1980 MRID 0078109	No
163.81-2	Acute Dermal Toxicity	No	Each Product[1]			No[2]
163.81-3	Acute Inhalation Toxicity	No	Each Product[1]			No[2]
163.81-4	Primary Eye Irritation	No	Each Product[1]			No[2]
163.81-5	Primary Dermal Irritation	No	Each Product[1]			No[2]
163.85-6	Dermal Sensitization	No	Each Product[1]			No[2]

[1]Each product or substantially similar product.
[2]The 10% and 20% pellet products are the same in use pattern and application. Therefore no additional data are required under section 3(c)(7)(A)(i) of FIFRA.

These data requirements are current as of December 1981. Refer to guidance package for updated requirements.

Chapter Four

Product Chemistry

A. Introduction

FIFRA 3(c)(2)(A) requires the Agency to establish guidelines for registering pesticides in the United States. The Agency requires registrants to provide quantitative data on all unintentional ingredients which are equal to or greater than 0.1% of the product by weight.

To establish the composition of products proposed for registration, the Agency requires data and information not only on the manufacturing and formulation processes, but also a discussion on the formation of manufacturing impurities and other product ingredients, intentional and unintentional. Further, to assure that the composition of the product as marketed will not vary from the composition evaluated at the time of registration, applicants are required to submit a statement certifying upper and lower composition limits for the added ingredients and upper limits only for some unintentional ingredients. Guidelines Subpart D (43 FR 29696) suggests specific precision limits for ingredients based on the percentage of ingredient and the standard deviation of the analytical method.

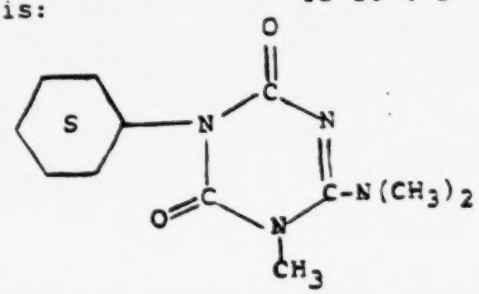
In addition to the data on product composition, the Agency also requires data to establish the physical and chemical properties of both the pesticide active ingredient and its formulations. For example, data are needed concerning the identity and physical state of the active ingredient (e.g., melting point data, ambient vapor pressure and solubility). Data are also required on the properties of the formulated product to establish labeling cautions (e.g., flammability, corrosivity and storage stability). The Agency uses these data to characterize each pesticide and to determine its environmental and health hazards.

B. Product Chemistry Summary - Technical Hexazinone

1. Chemical Identity

Hexazinone is the common name for the chemical 3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2, 4(1H,3H)-dione.

The empirical formula is $C_{12}H_{20}N_4O_2$ and the structural formula is:



E.I. DuPont de Nemours Company, Incorporated, Wilmington, Delaware, presently the sole manufacturer of hexaxinone in the United States, has assigned hexazinone the experimental number "INA-3674" or "DPX 3674" and the trade name Velpar® (MRID 0078058).

The Chemical Abstracts Registry (CAS) number for hexazinone is 51235-04-2 and the EPA Shaughnessy number is 107201. The common name, hexazinone, will be used throughout this Standard in lieu of other chemical or trade names.

2. Manufacturing Process

A full and adequate description of the manufacturing process for technical hexazinone (MRID 0078059) and the identification of impurities have been submitted by the registrant E.I. DuPont de Nemours & Company (MRID 0078060). These data are considered confidential business information and are contained in the confidential appendix to this Standard. A discussion of the specific procedures, equipment and manufacturing conditions required for commercial production of hexazinone cannot be published in this Standard.

3. Formation of Unintentional Ingredients

Data on the analyses of hexazinone have been provided by DuPont which adequately demonstrate that hexazinone does not contain detectable levels of dimethylnitrosamine at a method sensitivity of 0.1 ppm [GS/TEA] (MRID 0078060).

4. Active Ingredient Limits in Pesticide Products

The active ingredient limits for technical hexazinone contains a minimum of 97% of the active ingredient, 3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2, 4(1H,3H)-dione. The components of technical hexazinone have been identified. This is confidential business information and cannot be discussed in this Standard (MRID 0078058).

5. Product Analytical Method and Data

The analytical method (Nitrogen Selective Gas Chromatography) is adequate for identifying impurities for hexazinone and is adequate for enforcement purposes (MRID 0078058). Applicants for registration of proposed manufacturing-use products must provide a description of impurities and analytical method(s) for impurities. DuPont has submitted adequate data on hexazinone technical (MRID 0078090).

6. Physical and Chemical Properties (DuPont, 1973)

Technical Hexazinone

The physical and chemical properties of technical hexazinone as reported in the available data from the open literature and registrant submissions are as follow:

Color----------White (MRID 0078058)

Odor----------Odorless (MRID 0078058)

Melting Point----------115 - 117°C (MRID 0078058)

Solubility (MRID 0078058)

Solvent	Gms/100 gms Solvent at 25°C
Water	3.3
Choloroform	388
Methanol	265
Benzene	94
Dimethylformamide	83.4
Acetone	79.2
Toluene	38.6
Hexane	0.3

Stability----Stable in aqueous solutions at pH 5, 7 and 9 at temperatures up to 37°C. Subject to microbial decomposition in soil. (MRID 0078058)

Physical State----------Crystalline solid (MRID 0078058)

Specific Gravity----------1.25 (MRID 0078058)

Vapor Pressure----------6.4×10^{-5} mm Hg at 86°C.
2×10^{-7} mm Hg at 25°C
(extrapolated) (MRID 0078058)

Molecular Weight----------252.3 (MRID 0078058)

7. Data Gaps

The data gaps identified for technical hexazinone are:

pH, and octanol/water partition coefficient.

C. End-Use Products

The inert ingredients of the soluble powder, liquid, pellet and dry flowable formulations are exempted under Section 180.1001(c and e).

1. Manufacturing Process

Adequate data on the manufacturing process of the end-use formulations have been submitted to the Agency. This is confidential business information and cannot be discussed in this Standard.

2. Composition

The components of the end-use formulations (soluble powder, dry flowable, liquid and pellet) have been identified by DuPont and are contained in the Confidential Statement of Formula supplied to the Agency.

3. Product Analytical Methods

An acceptable analytical method that determines hexazinone in formulations has been submitted for the soluble powder, pellet and liquid end-use products. The description can be found in the confidential appendix and this method is suitable for enforcement purposes.

4. Physical and Chemical Properties

25% Liquid

Physical state ----------Liquid (MRID 0078065)
Density---------- 0.96 gm/ml (MRID 0078065)
Storage Stability----------25.5% (MRID 0078065)
Flammability----------74°F (MRID 0078065)

10% Pellet

Physical state----------Solid (MRID 0078061)
Denisty---------- 1.7 (MRID 0078061)
Storage Stability----------11.1% (MRID 0078061)

60% Dry Flowable

Physical state----------Solid (MRID 0078067)
Denisty---------- 0.55 (MRID 0078067)
Storage Stability----------61.5% (MRID 0078066)

90% Soluble Powder

Physical state----------Solid (MRID 0078067)
Color----------Beige

0.5% Liquid (EPA Reg. No. 179-89)

Physical state ----------Liquid (CSF)*
Weight----------8.4 (CSF)*
pH----------7.5 (CSF)*

5. Data Gaps

The data gaps for the end-use products are discussion of formation of unintentional ingredients (liquid, dry flowable only), declaration and certification of ingredient limits, color (dry flowable liquid pellet), odor, density (soluble powder only), boiling point (liquid only), viscosity (liquid only), miscibility (soluble powder, liquid), explosiveness (liquid), corrosion characteristics, product analytical methods and data (dry flowable only), pH, and storage stability (soluble powder only).

*Confidential Statement of Formulation

Chapter Five

Environmental Fate

A. Use Summary

Hexazinone is a non-selective herbicide used in non-cropland areas used as a selective herbicide in reforestation areas for pine release, and Christmas tree plantations; and in preemergence and postemergence treatments on sugarcane and alfalfa. It is used to control a large variety of annual, biennial and perennial weeds and undesirable woody plants. Registered use sites include sugarcane (in Florida, Hawaii, Louisiana, Puerto Rico, Texas), alfalfa, reforestation areas, Christmas tree plantations and noncropland areas such as railroad, highway, utility and pipeline rights-of-ways, petroleum tank farms, storage areas, industrial plant sites, and drainage ditchbanks. The Agency estimates that approximately 8 hundred thousand to 1 million pounds of hexazinone are produced annually.

Hexazinone apparently acts by inhibition of photosynthesis. Rainfall of 1/4 to 1/2 inch within two weeks of application provides the best weed control. Foilar applications are most effective under conditions of high temperature (above 80°F), high humidity, and good soil moisture. All formulations, except the pelletized product mix readily with water when vigorous agitation is employed.

Application of hexazinone is subject to certain use recommendations for different soil textures based on efficacy, leaching (soil texture), and organic matter in the soil. The application rates are varied in order to compensate for these soil differences. Recommendations for varied dosage rates are also made depending on size of weeds and weed density on a given site. The primary purpose of these recommendations is to ensure adequate weed control. The recommended application rates of hexazinone are contained in Table A.

Hexazinone controls an extensive spectrum of annual biennial and perennial weeds and undesirable woody plants. Target weeds in noncropland are listed in Table B.

Target weeds in sugarcane and alfalfa are listed in Table C.

TABLE A :

Registered Application Rates of Hexazinone

Site	Formulation	Application Method	Application rate (lb. or oz. a.i.)
Sugarcane	SP	Preemergence	.45-3.6 lb a.i./a[1] (Hawaii)
		Postemergence	.45-.90 lb a.i./a (FL, TX, LA)
		and/or layby	.45-1.8 lb a.i./a (Puerto Rico)
Alfalfa	SP	Preemergence or Postemergence	.5-1 lb a.i./a[1] 1.0-1.5 lb a.i./a[1]
Noncropland	SP	Broadcast	1.8-10.8 lb a.i./a[2/3]
	DF	Broadcast	1.8-10.8 lb a.i./a[2/3]
	P	Hand	1.0-4.0 lb a.i./a[3]
	L	Broadcast	2.0-12.0 lb a.i./a[2/3]
Bermudagrass and Bahiagrass (noncropland areas in SE and SW states)	SP	Broadcast	.675-1.125 lb a.i./a[2/3]
Christmas tree plantations & Reforestation areas	SP	Broadcast	.9-2.7 lb. a.i./a[1/2/3]
	L	Injection or Basal treatment	1.0-2.0 lb. a.i./a
Reforestation Areas conifer release	P	Hand	.5-1.5 lb. a.i./a[1/3]
Conifer site preparation	P	Hand	.75-3 lb. a.i./a[1/3]
Individual tree control	P	Hand	2-3 pellets/inch of diameter at breast height

1/ Rate varies with soil type and state specified.
2/ Aerial application
3/ Ground application

TABLE B

General Weed Control in Non-cropland Areas

For season-long control of:

Bahiagrass*
Bermudagrass*
Bluegrass
Broomsedge
Camphorweed
Canada thistle*
Chickweed
Clovers
Dewberry
Dog fennel
Fescus*
Fingergrss
Foxtail
Guineagrass
Health aster
Honeysuckle
Lantana
Marestail*
Natalgrass
Plantain
Prickly lettuce
Ragweed
Smutgrass
Spanish needle
Vaseygrass
Wild blackberry*
Wild carrot

For short-term control of:

Barnyardgrass
Bindweed*
Bouncing bet*
Bromegrass
Buffelgrass*
Burdock
Cocklebur
Crabgrass
Crown vetch
Curly dock*
Dandelion*
Dogbane*
Fiddleneck
Filaree
Fleabane
Goatsbeard vine
Goldenrod
Lespedeza
Milkweed*
Mustard
Nutsedge*
Orchardgrass*
Oxalis
Paragrass
Pigweed
Purslane
Quackgrass
Ryegrass
Smartweed
Spurge
Trumpet creeper*
Wild oats
Wild parsnip
Wild star thistle

Woody plants:

American elder, balsam poplar, birch, black cherry, blackgum**, black hickory, boxelder, brambles (such as blackberry, dewberry, and raspberry), cherry*, chokecherry, cottonwood, dogwood*, eastern redcedar, elm, green ash, hawthorn, hickory*, hornbeam, mulberry, multiflora rose, Norway maple, oaks (black, blackjack, post, southern red, turkey, water, and white oak), red maple, Russian olive, sumac, sweetgum, white ash, wild plum, and willow.

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*Considered hard-to-kill

TABLE C

Target Weeds in Sugarcane and Alfalfa

Sugarcane

Ageratum
Alexandergrass
Amaranth (slender, spiny)
American burnweed (fireweed)
Balsam apple
Barnyardgrass
Bermudagrass
Carolina geranium
Castorbean
Chickweed
Crabgrass (hairy, large, smooth)
Crotalaria (showy, fuzzy)
Cuphea (tarweed)
Fingergrass (radiate, swollen)
Flora's paintbrush
Foxtail (bristly, yellow)
Goosegrass
Guineagrass
Henbit
Itchgrass
Jobs tears
Johnsongrass (from seedling)
Junglerice
Lambsquarters
Morningglory (hairy, threelobe)
Mustard (wild)
Oxalis
Panicum (broadleaf, browntop, Texas, millet, blue)
Paspalum (dallisgrass, ricegrass, sour, vaseygrass)
Pigweed (common, smooth)
Popolone
Purslane
Sandbur
Sensitiveplant (Hila Hila)
Signalgrass (broadleaf)
Sowthistledles
Spanishneedles
Sprangletop
Spurge (prostrate, graceful)
Sunflower
Waltheria (Hialoa)

Alfalfa

Annual bluegrass
Blue mustard
Broadleaf plantain
Common chickweed
Common dandelion
Common groundsel
Common lambsquarters
Crabgrass
Downy brome (bromus tectorium)
Fiddleneck
Field pennycress
Filaree
Fleabane
Foxtail
Jimsonweed
Orchardgrass
Prickly lettuce
Redroot pigweed
Ryegrass
Salsify
Seedling alfalfa
Sheperdspurse
Speedwell
Spurry
Sweet clover
Tansy mustard
Wild oat
Yellow rocket

There are currently seven end-use products that are single active ingredient products. They include a 90% soluble powder, three liquids 0.48, 0.5 and 25%, and two pelletized products 10 and 20%. The soluble powder is the only product registered for use on sugarcane and alfalfa in certain states under Section 24(c) of FIFRA. The federally registered end-use products are currently registered for application on noncropland, reforestation areas and Christmas tree plantations, except for the dry flowable end-use product which is not registered for use on reforestation areas and Christmas tree plantations.

The 0.5% liquid formulation "BO-RID V-4 LIQUID WEED KILLER" (EPA Reg. No. 179-89) is manufactured by R.H. Bogle Company, P.O. Box 588, Alexandria, Va. 22313.

The 0.48% liquid formulation "MOBLEY V-4 LIQUID WEED KILLER" (EPA Reg. No. 20001-7) is manufactured by ACD Mobley Company, Inc., 3800 Stone Road, Kilgore, Texas.

There are thirty Section 24(c) labels registered for variations of the use patterns described previously for the states of AL, AR, CA, FL, GA, LA, MS, NC, OK, SC, TN, TX, DE, MI, MD, OR, VA, WA, WV and MN with several states holding more than one registration. The use patterns are generally the same as the Federally registered products.

B. Environmental Fate Profile

Root uptake is the principal mechanism for the absorption of hexazinone by plants from soils. Hexazinone is translocated to the foliage where it blocks the photosynthetic process. In addition to plant uptake, hexazinone is dissipated in soil via photodegradation, biodegradation and leaching. Laboratory tests in which soil films were subjected to artificial sunlight yielded a photodegradation half-life of 37 days for hexazinone. Greenhouse and field soil degradation tests using ^{14}C-labeled hexazinone have indicated that hexazinone degrades in soil biologically under both aerobic and anaerobic conditions. Depending on field conditions, half-life of hexazinone in soil may be as short as 1 month or in excess of 6 months. The half-life appears to be independent of the application rate. Using thin layer chromatography-liquid scintilation counting, several triazine compounds have been identified as hexazinone degradation products. Laboratory and field leaching tests have indicated that hexazinone and some of its degradation products would be washed into the soil with rainwater. Photodegradation and biological decomposition are the major factors in reducing hexazinone concentration in natural waters.

C. Environmental Fate Technical Hexazinone

1. Hydrolysis

Hexazinone does not hydrolyze appreciably in water within the pH range of 5.7 to 9. Hexazinone is stable to hydrolysis. Available data indicate that photodegration and biological decomposition are the major contributing factors to the reduction of hexazinone concentration in natural waters; hydrolysis does not appear to contribute to hexazinone dissipation.

Hydrolysis studies consisted of tests on the following solutions of ^{14}C-labeled hexazinone: (a) 5990 ppm (5 lb/100 gal) in 0.05 M pH 5.7 and 9 aqueous buffers at 15°C; (b) 5 ppm in 0.05 M pH 5.7 and 9 aqueous buffers at 15°C; and (c) 5 ppm in 0.05 M pH 7 buffer at 25° and 37°C. Samples were taken for analysis at one week intervals for 8 weeks and applied to silica gel TLC plates, developed and radioscanned. Less than 1% degradation was observed in any sample. Mass spectrometeric analysis of one of the samples showed it to be the same as a reference standard. These results indicate that hexazinone does not hydrolyze appreciably in water (Rnodes, 0078037).

2. Photodegradation

Water

Photodegradation studies were carried out by DuPont (Rhodes, 0078037) in water under artificial light. Solutions 2 inches deep were kept at 15°C for 8 weeks. The two sample solutions were hexazinone in distilled water (pH 6.7) and in standard reference water (pH 8.1). Twenty-six percent of hexazinone was degraded after 8 weeks in distilled water exposed to artificial sunlight. In standard reference water, decomposition occurs three times faster and in river water about seven times faster. Table 1 summarizes the results for the artifical sunlight photodegradation tests (Rhodes, MRID 0078037).

Table 1 ARTIFICAL SUNLIGHT PHOTODEGRADATION TEST RESULTS
(% OF INITIAL ^{14}C)

^{14}C Compound R_f		Distilled Water					Standard Reference Water				
	Weeks	1	2	4	6	8	1	2	4	6	8
0.00		—	1	2	3	5	—	2	5	8	10
0.13		—	1	2	3	5	—	7	9	14	23
0.27		—	2	3	4	5	—	2	4	6	7
0.50		100	95	91	87	82	100	87	79	68	55
0.80		—	—	1	2	2	—	1	1	2	2
0.90		—	1	1	1	1	—	1	2	2	3

Natural degradation under sunlight was also studied by DuPont using 5 ppm ^{14}C-labeled hexazinone solutions prepared with the following water samples: (a) standard reference water, pH 8.1; (b) standard reference water containing 20 ppm riboflavin (a photo initiator); (c) Brandywine River water; and (d) Brandywine River water with bottom sediments. The reference water used contained appropriate amounts of specific inorganic salts equivalent to a typical U.S. surface water. These samples (200 ml 2 inches deep) were exposed to full day sunlight for 5 weeks, analyzed by TLC (chloroborm, methanol solvent) and counted. The experimental results, presented in Table 2, indicate that hexazinone degrades under laboratory conditions and in natural sunlight in a variety of aqueous solutions and is more stable in natural waters when sediments are present (Rhodes, MRID 0078037).

Table 2 . DEGRADATION OF HEXAZINONE IN WATER SAMPLES EXPOSED TO SUNLIGHT
(% OF TOTAL ^{14}C APPLIED)

^{14}C Compound R_f		Reference Water		Reference Water + Riboflavin		Brandywine River Water		Brandywine Water + Sediment	
	Weeks	1	5	1	5	1	5	1	5
0.00		-	-	1	-	-	9	-	2
0.40		-	6	4	13	6	16	-	6
0.50		3	17	6	16	3	18	6	11
0.70		-	8	9	15	-	8	-	10
0.80		97	69	80	56	91	49	94	71

Soil

Hexazinone on the soil surface is subject to photodegradation under the action of sunlight. In a study by DuPont, Flanagan silt loam was treated with 10 ppm of ^{14}C-parent compound, slurried and placed in petrie dishes. Soil film thickness was about 500 microns. Photosource was artificial sunlight at six inches from soil film. Exposure continued for 6 weeks. The half-life of the parent compound on the soil surface when exposed to artificial sunlight (by simple linear regression) was estimated to be 37 days, with 40% of the parent remaining at 6 weeks. The major photodegradation product was 3-cyclohexyl-1-methyl-6-(methylamino)-1,3,5-triazine-2,4-(1H,3H)-dione (compound B). Minor photodegradation products were 3-(4-hydroxycyclohexyl)-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4-(1H,3H)-dione (compound A) and the triazine trione (compound D) (Rhodes, MRID 0078038).

3. Metabolism

Aerobic/Anaerobic Soil

Greenhouse soil metabolism tests conducted by DuPont using ^{14}C-labeled hexazinone demonstrate that hexazinone is degraded by the action of soil microorganisms under both aerobic and anaerobic conditions, although the rate of degradation is somewhat slower under anaerobic conditions. Two soil types (Fallsington sandy loam and Flanagan silt loam) were fortified with 4 ppm hexazinone. Moisture content was maintained and samples were taken periodically. Water/acetone extracts of the samples were analyzed by a TLC-LSC procedure. Under aerobic conditions the half-life of extractable ^{14}C in both soils was about 25 weeks. Of the extractable ^{14}C in both soils at 25 weeks, about half was present as 3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4(1H,3H)-dione (parent) and/or 3-cyclohexyl-1-methyl-6-methylamino-1,3,5-triazine-2,4-(1H,3H)-dione (Compound B). Compounds A, C, D, E, F, G, and H were also present with A and/or D being the only other major metabolites (Rhodes, MRID 0078038).

Microbes on Hexazinone

Data indicate that microbial degradation contributes to the decomposition of hexazinone in soil. After 80 days, 45 - 75% of the original ^{14}C was evolved as $^{14}CO_2$ as a carbon source and that the triazine ring was broken to liberate $^{14}CO_2$. No microbes were identified in this study but soil pH (pH 5-5.6) indicates that they were most likely fungi rather than bacteria. The initial 10-20 day lag

period before $^{14}CO_2$ begins to evolve rapidly indicates that the degrading microbes must either build up their population and/or synthesize the necessary enzymes before significant degradation can occur. Other submitted data suggest that Aspergillus, Penicilluim, and Fusarium are the most likely degrading fungi (Kraus, MRID 0078024).

Hexazinone on Microbes

Data demonstrates that 10 ppm of hexazinone did not have significant effect on soil fungi or bacteria over an 8 week interval in three soil types (Florida fine sand, Fallsington sandy loam and Keyport silt loam). In other studies with Fallsington sandy loam and Keyport soil loam, 5 ppm and 20 ppm of hexazinone had no effect on nitrifying bacteria (Williams, MRID 0078045).

4. Mobility

DuPont reported on soil TLC mobility tests using the techniques of Helling and Turner. R_f values were 0.85 for Fallsington sandy loam and 0.68 for Flanagan silt loam. These values correspond to a Class 4 pesticide in the Helling and Turner pesticide mobility clasification system (Rhodes, MRID 0078039).

Leaching

In laboratory column leaching studies (Rhodes; MRID 0078039), ^{14}C-hexazinone was aged 30 days and appplied to Flanagan silt loam and fallsington sandy loam at a rate of 4 lbs. ai/acre. Water was percolated through the prewetted columns at tne rate of 0.2 in/hr until a total of 20 inches was collected. 0.2-inch increments were collected for analysis. A sodium chloride-^{36}Cl breakthru v lume test was also run.

The soil column leaching tests indicate that hexazinone is leached in the soils. Leaching rates are much lower for "aged" samples indicating the formation of less water soluble or more highly absorded degradation products.

Field soil degradation studies were also used to evaluate the potential for leaching of hexazinone from the soil. The results indicate that hexazinone and at least some of its degradation products are washed into the soil with the rainwater. The distributions of ^{14}C as a function of soil depth and total rainfall are shown in Tables 3 and 4 for Keyport silt loam and Flanagan silt loam, respectively (Rhodes, MRID 0078039).

TABLE 3. Leaching of Hexazinone in Keyport Silt Loam*

Soil Depth (in)	% of Applied ^{14}C			
0 - 1	99.4	26.8	17.2	11.6
1 - 3	<0.1	24.3	17.1	16.8
3 - 5	<0.1	7.4	11.7	18.2
5 - 8	<0.1	5.0	4.2	9.6
8 -12	<0.1	2.7	3.8	6.2
	99.4	66.2	54.0	62.4
Total rainfall	0.00	8.43	12.29	13.79
Exposure time (month)	0	1	2	3

*Composition and characteristics: sand 21%, silt 62%, clay 17%, organic matter 2.75%, nitrogen 0.97%. pH 6.5, cation exhange capacity 8.2 me/100g.

TABLE 4. Leaching of Hexazinone in Flanagan Silt* Loam

Soil Depth (in)	% of Applied ^{14}C		
0 - 1	99.9	103.5	22.4
1 - 3	<0.1	0.2	38.6
3 - 5	<0.1	<0.1	17.9
5 - 8	<0.1	<0.1	2.5
8 -12	<0.1	<0.1	0.5
12 -15	<0.1	<0.1	0.1
	99.1	103.7	81.9
Total rainfall	0.00	0.25	7.04
Exposure time (month)	0	0.5	1

*Composition and characteristics: sand 5%, silt 64%, clay 31%, organic matter 4.02%, nitrogen 0.282%, pH 5.0, and cation exhange capacity 23.4 me/100g.

5. Soil Field Dissipation

In tests with Keyport silt loam in Delaware, TLC-LSC analysis indicated 95%, 29%, 7% and 4% unchanged hexazinone remaining in the soil after 0, 1, 2 and 3 months exposure. At 3 months 90% of the extracted ^{14}C had R_f values corresponding to the hydroxycyclohexyl compounds A and C. Sixty-eight percent of total ^{14}C was extractable. Tests with Flanagan silt loam in Illinois indicated percent unchanged hexazinone in soil extracts of 99%, 94% and 62% after 0, 0.5 and 1.0 months, respectively. Based on these results it was concluded that hexazinone half-life in field soils could be as short as 1 month but may exceed 6 months. Based on TLC R_f values, hydroxycyclohexyl A and C were tentatively identified as the major degradation products in the silt loam field soil (Rhodes, MRID 0078038).

In a separate study with the Keyport silt loam, four application rates (1.8, 4.0, 9.2 and 20 lb ai/acre) were used to evaluate the persistence of hexazinone in the soil. At the highest application rate of 20 lb ai/acre (calculated at 15 ppm in soil), about 15% of hexazinone remained in soil after 6 months as combined hexazinone and metabolites A and B. Some leaching of parent compound down to a depth of 12-18 inches was also observed. When surface applied at a rate of 9.2 lb ai/acre (calculated at 6.9 ppm), test results indicate that the half-life of hexazinone is apparently independent of the application rate (Holt, MRID 0078020).

6. Terrestrial Forest Field Dissipation

Four small forested watersheds (21 to 2.7A) in the upper Piedmont of Georgia were treated with 14.9 lb/A of 10% hexazinone (pellet formulation). A series of 19 storms, from the end of April until December 1979, were monitored to determine off site movement of hexazinone and two metabolities A and B. The four watershed test areas drained into a stream that flowed into the larger Moonshine creek. A fifth watershed served as a control. The five watersheds produce flow only during storms. Water samples were collected after storm run-off and soil samples 3, 14, 30, 60 and 90 days after the first rain following herbicide application (MRID 007809l).

Total output of hexazinone residues average 0.5 percent of the total herbicide applied. Residues were detected in a second perennial stream below the treated watersheds in concentrations less than 44 ppb. A study of aquatic invertebrates and macrophytes in the treated section

of this stream indicated that hexazinone residues did not accumulate. The fish in the creek were not analyzed for hexazinone residues because other studies demonstrated that hexazinone does not accumulate significantly in fish.

The forest ecosystem study indicate that the use of hexazinone in reforestation areas does not appear to cause adverse environmental effects.

7. Rotational Crop Accumulation

Alfalfa

Other crops are often rotated with alfalfa. In a crop rotation study (MRID 0078089), corn and potatoes were rotated with alfalfa with maximum recrop intervals of 78 days and one year, respectively. Data demonstrate that no detectable levels of hexazinone are expected in corn and potatoes. The test results are sufficient to support the existing 12-month restriction.

Replanting: "Corn or potatoes may be planted 12 months after treatment, provided the soil is deep disked or plowed prior to planting, except in low annual rainfall areas (less than or equal to 20"). Do not plant treated areas to any other crop within two years after treatment."

8. Fish Accumulation

Bluegill sunfish were exposed to 0.0116 ppm and 1.16 ppm ^{14}C-hexazinone over a 28 day exposure period and edible tissue, viscera, and liver were sampled. The results indicate no decomposition of hexazinone over the 28 day exposure interval. Fish samples showed very little accumulation of ^{14}C equivalent to parent compound with maximum residues of about 7 ppm in fish viscera from the 1.0 ppm exposure level. The residues found in the fish samples were closely correlated to exposure concentration. During the withdrawal period, ^{14}C equivalent to parent compound declined more than 90% in all tissues during 2 week period. Under the conditions of the study, bluegill sunfish do not accumulate significant residues of ^{14}C equivalent to hexazinone under the experimental conditions used (Rhodes, MRID 0078032).

D. Exposure Profile

1. End-use Products

The potential for exposure of humans, livestock, fish and wildlife is minimal. The greatest potential for exposure is likely to occur during dilution, mixing and application operations. A potential for eye exposure exists due to the handling and mixing processes. Hexazinone is an eye irritant and it is important that users of hexazinone products wear goggles or face shield and rubber gloves in application methods as required by the current product label.

E. Data Gaps

The environmental fate data gaps are: anaerobic soil metabolism, anaerobic aquatic metabolism, aerobic aquatic metabolism, leaching, adsorption/desorption, field dissipation (field and vegetable crop), dissipation (noncrop).

Chapter Six

Toxicology

A. Toxicology Profile

1. Technical Hexazinone

The available data on acute oral, dermal and inhalation studies, primary eye and skin irritation studies and dermal sensitization studies were adequate to evaluate the effects from the use of technical hexazinone. These data have shown the oral LD_{50} in rats to be 1690 mg/kg and in guinea pigs 860 mg/kg. The dermal LD_{50} in rabbits is >5,278 mg/kg with slight skin irritation and the LC_{50} inhalation in rats is >7.48 mg/l. Data on primary eye irritation indicate that hexazinone is an eye irritant and the primary skin irritation and dermal sensitization studies demonstrate that this herbicide is not a skin irritant.

The toxicity categories for technical hexazinone are:

Acute Oral	III
Acute Dermal	III
Acute Inhalation	III
Primary Eye Irritation	II
Primary Skin Irritation	III
Dermal Sensitization	III

2. End-Use Products

60% Dry Flowable

No data were available on acute inhalation and dermal sensitization. Adequate data are available on acute oral, primary eye and skin irritation studies.

25% Liquid

Adequate data are available on primary eye irritation. No data were submitted on acute inhalation. Data submitted on acute oral and dermal toxicity, primary skin irritation and dermal sensitization were inadequate to demonstrate the effects of hexazinone in liquid formulations. The uses of this product are essentially identical to the currently registered pesticide products EPA Reg. Nos. 352-378 (SP), 387(P), and 388 (F). Therefore, no additional data are required.

10% Pellet

Adequate data are available on acute oral LD_{50}. Testing on technical hexazinone will fill the data requirements for acute dermal and inhalation studies, primary dermal eye irritation and dermal sensitization studies.

90% Soluble Powder

Adequate data are available to assess the effects of hexazinone in soluble powder formulations for acute oral, dermal, and inhalation studies, primary eye and skin irritation studies and dermal sensitization studies.

0.5% Liquid

Available data are adequate to assess the acute effects, primary eye and dermal irritation of hexazinone for this formulation.

20% Pellet

Testing on technical hexazinone will fill the data requirements for the primary eye and skin irritation studies and dermal sensitization study.

B. Chronic Studies - Technical Hexazinone

1. Subchronic Oral Toxicity

Rat

Subchronic 90-day feeding studies with velpar have been conducted on both rats and dogs (Sherman, MRID 0078043).

Hexazinone was fed to 30-day old male and female rats (16/sex/group) for 3 months at levels of 0, 200, 1000, and 5000 ppm in the diet (DuPont 1973). Animals receiving the highest concentration of hexazinone, 5000 ppm, exhibited body weight gains that were slightly less than those of the control rats and had lower food efficiency values. However, none of the test groups showed other nutritional, clinical, hematological, urinary, or biochemical evidence of toxicity. Histopathological examination of tissues from animals in the 5000 ppm group showed no evidence of toxicity. The NOEL is 1000 ppm (MRID 0078043).

Dog

In the subchronic feeding study (DuPont, 1973) with dogs, young adult male and female beagles (16/sex/group) ages 10 to 18 months were fed for 3 months at dietary levels of 0, 200, 1000, an 5000 ppm of velpar (97.5% a.i.) in the test diet (DuPont 1973). The only clinical sign of toxicity observed was slightly reduced weight gain at 5000 ppm. At this dietary concentration, the dogs also exhibited significantly ($p<0.05$) elevated alkaline phosphatase activities and lower albumin:globulin ratios; this suggests some injury to the liver. Both male and female dogs at the highest concentration (5000 ppm) had slightly heavier livers and increased liver-to-body weight ratios than the controls. No histopathological change was observed in the liver or other organs examined of the four animals of each sex from both the 5000 ppm and control groups. The NOEL is 1000 ppm (MRID 0078004).

2. Chronic Feeding

In a chronic feeding study, male and female rats (33 day old animals) were fed hexazinone for two years at levels of 0, 200, 1000 and 2500 ppm of an adequate nutritional diet. The average body weight gains of males and females receiving dietary levels of 2,500 ppm hexazinone and of females receiving 1,000 ppm, hexazinone were lower than those of the controls and other test groups. Slightly lower food efficiency values were seen for these groups as was a decreased food consumption for high level male rats (2,500 ppm, hexazinone). There were no clinical signs of toxicity that could be attributed to the feed of hexazinone and no meaningful differences among mortality rates for control and test rats. Male rats fed 2,500 ppm hexazinone had significantly higher total leucocyte counts and relative eosinophil counts; male and female rats fed 2,500 ppm hexazinone excreted a more alkaline urine than the controls and other test groups. There were no clinical, or other hematological and urinary evidence of toxicity. No significant gross or histopathologic changes were observed in any of the test rats that could be attributed to the feeding of hexazinone. The no-effect level for this compound was 200 ppm (Kaplan, MRID 0078022).

3. Oncogenicity

Available data on mice, submitted July 31, 1981, is currently under review.

4. Teratology

Pregnant albino rats were fed technical hexazinone from day 6 through day 15 of gestation at levels of 0 (control), 200, 1000, and 5000 ppm (25-27 rats each level group, 4 groups with a total of 104 rats) in the diet. All animals were sacrificed on 21st day of gestation.

The feeding of 5000 ppm of technical hexazinone decreased the food consumption and body weight gain of pregnant rats only slightly. No adverse effects on the number of implantations, resorptions, live fetuses per litter and mean weight and crown-rump length of the fetuses were found. No malformation or major abnormalities were noticed in fetuses exposed to the test material. The material was neither embryotoxic nor teratogenic at 5000 ppm, the highest level tested (DuPont 1974, MRID 0078009).

In another study conducted (DuPont, 1980) four groups of female rabbits were artificially inseminated and later dosed with either 0, 20, 50, or 125 mg/kg/day of 100% hexazinone on day 6-19 of gestation. The test material, dissolved in 0.5% methocel, was administered by gavage. On day 29 the pups were delivered by Cesarean delivery. The dams and all pups were subsequently examined for abnormalities. The results were as follows:

Maternal Data

Only minor differences were noted in the controls and high dose group test dams with respect to clinical signs and body weight, etc. No dose dependent gross pathological lesions were noted.

Cesarean Data

No consistent statistical differences between controls and test animals in pregnancy rate, uterine weight, corpora lutea, implantations, fetal viability or size were noted or reported.

Pup Data

There were 4 incidences of pups with remarkable soft tissue and skeletal abnormalities but the pattern of occurrence did not demonstrate a dose dependent response. The highest dose level showed a higher percentage (16.2%) of fetuses showing variants than did controls (5.3%) in skeletal development. Notable differences included delayed ossification in extremities and also extra ribs.

The teratogenic NOEL is 125 mg/kg. Hexazinone is not teratogenic at 125 mg/kg.

5. Reproduction

Summary data from a three-generation reproduction study carried out with rats that received 0, 200, 1000, 2500 ppm hexazinone in the diet, showed no meaningful differences among control and test groups with respect to reproduction and lactation performance. However, the average body weight of the pups at weaning in the group receiving the highest dietary level of hexazinone (2500 ppm) was slightly lower than those of the controls and other test groups in the F2A and F3A litters. The NOEL is 2500 ppm (DuPont, MRID 0078070).

6 Mutagenicity

Hexazinone was tested in Salmonella typhimurium strains in concentrations of 400, 800, 1200, 1600 and 2000 ug per petri plate. The compound was not mutagenic in the microbial assays either in the presence or absence of a liver microsomal activating system, i.e., it did not induce a significant increase over the spontaneous mutation frequency. There is no evidence that hexazinone is mutagenic (DuPont, MRID 0078011).

In summary, hexazinone is not mutagenic when tested in concentrations of 400, 800, 1200, 1600 and 2000 ug. The no observable effect level (NOEL) for the chronic tests are:

Studies	NOEL
Subchronic Oral Toxicity	1000 ppm
Chronic Feeding	200 ppm
Reproduction	250 ppm
Teratology	125 mg/kg

The mouse oncogenicity study is under review.

7. Metabolism

Available data are inadequate to evaluate the effects of hexazinone.

C. Hexazinone End-Use Products

1. 60% Dry Flowable

Acute Oral Toxicity

The test material as a suspension in corn oil, was administered by intragastric intubation to 8 groups of male rats (10 rats

each group) in single doses on the basis of 3200, 3500, 4000 4500, 5000, 6000 and 7500 mg/kg b.w. The animals were observed 14 days after the treatment. Two animals in each of 8 test groups were subjected to gross examination. The LD_{50} was 4495 mg/kg b.w. The toxicity category is III (DuPont 1977, MRID 0078023).

Acute Dermal Toxicity

The available data were inadequate to assess the acute dermal effects of hexazinone dry flowable formulation.

Acute Inhalation Toxicity

No acute inhalation toxicity studies are available on the dry flowable formulation.

Primary Eye Irritation

The right eyes of 6 white rabbits were treated with a dose of 0.1 ml (21.3 mg) and left eye served as controls. The eyes were examined 1, 2, 3, 7 and 14 days after treatment (DuPont 1978, MRID 0078015).

Data indicate that the test material caused corneal opacity which was not reversible on the 7th day (3/5) and the 14th day (2/6). The formulation product is considered as an eye irritant. The toxicity category is II.

Primary Dermal Irritation

Six male albino rabbits were clipped free of hair on the trunk and lateral areas. Doses of 0.5 gm of the test material were applied to the intact and abraded skin under the gauze squares. The test material was found not to be a primary skin irritant and the score for irritant classification is 75. The toxicity category is II (DuPont 1977, MRID 0078072).

Dermal Sensitization

No dermal sensitization studies are available on the dry flowable formulation. Testing on technical hexazinone will fill this requirement. The toxicity category is III.

2. 25% Liquid

Test results from the primary eye irritation study demonstrate that this formulation causes corneal injury and irritation. The toxicity category is I. Data submitted on acute oral and dermal toxicity, primary skin irritation, and dermal sensitization were inadequate to demonstrate the effects of hexazinone. No acute innalation study was submitted.

3. 10% Pellet

Acute Oral Toxicity

Ten male rats were dosed with 7.5 g/kg of the formulation suspended in corn oil. All animals survived for the 14 day observation period. The only adverse effect noted was slight weight loss on the day after dosing. Gross necroscopy performed on two animals, sacrificed at day 14, was remarkable. The toxicity category is III (DuPont 1977, MRID 00780711).

Acute Dermal Toxicity

Testing on technical hexazinone will fill this requirement based on the low dermal toxicity results obtained. The toxicity category is III.

Acute Inhalation

Testing on technical hexazinone will fill this requirement based on the low inhalation toxicity results obtained. The toxicity category is III.

Primary Eye Irritation

10 mg powder was placed in a rabbit eye and washed after 20 seconds. The material produced moderate but reversible corneal injury and conjunctivitis if not washed. If washed, these signs would be less severe. The toxicity category is II (DuPont 1978, MRID 00780115).

Primary Dermal Irritation

Testing on technical hexazinone will fill this requirement. The toxicity category is III.

Dermal Sensitization

Testing on technical hexazinone will fill this requirement.

4. 90% Soluble Powder

Testing on technical hexazinone will fill the data requirements for acute oral, dermal and inhalation toxicity,.primary eye and skin irritation and dermal sensitization. The toxicity category is III for acute oral, dermal and inhalation, primary dermal and dermal sensitization. The toxicity category for primary eye irritation is II.

5. 0.5% Liquid (EPA Reg. 179-89)

Acute Oral

5M and 5F Sprague - Dawley rats weighing between 205 and 228 grams received a 5000 mg/kg dose of the test material. Observations were made at 1, 2, and 4 hours post dose and twice daily thereafter for 14 consecutive days. No mortalities or signs of toxicity were noted in any of the test animals during the 14 days of observations. The LD_{50} is greater than 5000 mg/kg. The toxicity category is IV (MRID 0078093).

Acute Dermal

5M and 5F New Zealand white rabbits received a 2 g/kg dose of the test material on abraded skin sites. The treated areas were placed under occlusive wraps for 24 hour exposure. Observations were made at 1, 3, 7, 10 and 14 days.

No mortalities or clinical signs were noted. The LD_{50} is greater than 2 g/kg. The toxicity category is III (MRID 0078094).

Acute Inhalation

5M and 5F Sprague-Dawley rats weighing between 261 and 338 grams received at 5.0-5.5 mg/l nominal concentration of the test material for 4 hours. The animals were exposed to the test material in a 100-litter glass and stainless steel chamber that operated dynamically at a consistent airflow of 16.7 l/min. The temperature was between 77° to 79°F and relative humidity 49 to 60%. The animals exhibited normal behavior. The toxicity category is IV (MRID 0078095).

Primary Eye Irritation

Nine New Zealand white rabbits received a 0.1 ml dose of the test material in the left eye. The animals were divided into two groups. Group I consisted of 6 animals with treated, unwashed eye and Group II consisted of 3 animals with treated washed eyes. Observations were made at 24, 48 and 72 hours and days 4 and 7. No corneal opacity, iritis or conjunctive irritation were noted in any of the treated eyes during the observation period. The toxicity category is IV (MRID 0078096).

Dermal Irritation Study

A 0.5 ml aliquiot of the test material was applied to two abraded and two intact skin sites per animal for 24 hour

exposure under occlusive wrap. Observation were made at 24 and 72 hours. No erythema or edema were noted at any site during the 72 hour exposure period. The toxicity category is IV (MRID 0078097).

6. 20% Pellet

Acute Oral Toxicity

Hexazinone was administered orally to fasted young male and female rats in single doses. Its LD_{50} is greater than 5000 mg/kg of body weight. The results of this study indicate that hexazinone has very low toxicity. The pellet size (1cc) will minimize any potential dermal or inhalation hazard (MRID 0078082).

D. Data Gaps

1. Technical Hexazinone

The data gap for the technical grade hexazinone is a rat metabolism study.

2. End-Use Products

Currently, the data requirements have been satisfied except for the 60% dry flowable which requires submission of the following data: acute dermal and inhalation toxicity, dermal sensitization.

Chapter Seven

Residue Chemistry

A. Residue Chemistry Profile

Available data indicate that no detectable hexazinone residues were found in or on sugarcane nor in any of the processed fractions (sugar, molasses or bagasse) at recommended application rates. No secondary residues in milk, meat, poultry, and eggs are anticipated. Livestock must not be fed sugarcane forage because adequate data were not available to demonstrate the effects of hexazinone in sugarcane forage.

Data on alfalfa demonstrate that no detectable hexazinone residues are expected in poultry feed items and no secondary residues are expected in poultry, eggs, milk and meat.

B. Nature of Residue in Plants

1. Sugarcane

A metabolism study (Rhodes, 1975) was carried out on greenhouse-grown dwarf sugarcane that was treated with ^{14}C-labeled hexazinone (MRID 0078035).

Sugarcane were grown in large tubs (2 canes/tub) and when the canes reached 5.5 to 6 feet in height, they were treated with a soil drench application of ^{14}C-labeled hexazinone at rates of 0.5 and 1.0 kg/ha (0.45 and 0.89 lb a.i./acre). A third tub was maintained as a control. About 6 months after treatment, 76% of the radioacitivity was extracted. The residues calculated as hexazinone were 0.07 - 0.08 and 0.05 ppm in sugarcane treated at 0.89 and 0.45 lb a.i./acre.

In the extracted radioactivity, <1% was identified as hexazinone, 20% as Metabolite A, 2% as Metabolite B, 32% as Metabolite C, 4% as Metabolite D and 42% as Metabolite E.

2. Alfalfa

In a study conducted at the University of Kentucky Research Farm, a 12 ft^2 area of alfalfa was isolated, fenced and marked for a radioactive test. In mid-March the test plot was sprayed, using a hand-held sprayer, with 125 mg ^{14}C-labeled hexazinone (890 uCi) dissolved in 100 ml water (1 lb. a.i./100 gal/acre). Three alfalfa crops were harvested at two, three, and six months after treatment. Total ^{14}C-residues calculated as hexazinone were 0.6, 0.5 and 0.1 ppm.

The extractable percentages of radioactivity were 95, 84 and 80% for the two-, three- and six-month harvests, respectively.

The two-month alfalfa cutting contained 2.7% hexazinone, 7.1% free Metabolite A, 017% free Metabolite B and 4.5% conjugated Metabolites A, B and C. The remaining extractable ^{14}C(69.9%) was bound into natural products (amino acids, sugars, polybasic acids, acetic acid/acetates and lignin) (MRID 0078030).

The nature of the residues in alfalfa and sugarcane is adequately understood.

C. Residues in Animals

1. Goat

Two lactating nanny goats were given 5 consecutive daily doses of ^{14}C-labeled hexazinone in the diet at rates of 1 and 5 ppm. The ^{14}C-hexazinone (Velpar) was degraded by hydroxylation and dimethylation.

Hexazinone and metabolites A, B, and D were found in both the urine (80% of the total dose) and feces (6% of the total dose). The distribution of activity into milk was 0.49 - 1.36% (total dose) on the 5th day; in this distribution, the components were 5-6% hexazinone, 50-57% metabolite A, 12-29% metabolite B and 5-30% polar material. In liver (overall distribution = 0.15 - 0.47%), ^{14}C-hexazinone accounted for 56.4% (extractable + hydrolyzed unextractable) of the overall distribution, and the other components were 7.7% metabolite A, 24% metabolite B, 3.9% metabolite D and <0.1% metabolite H. In kidney (overall distribution = 0.02 - 0.05%), ^{14}C-hexazinone accounted for 3% of the overall distribution, the other constituents were 47.3% metabolite A, 16.3% metabolite B, 1.6% metabolite D and 6.3% metabolite H. In loin meat (0.01 ppm ^{14}C in tissue), the hydrolyzed tissues contained <0.01% hexazinone, 14.8% metabolite A, 5.9% metabolite B and 3.1% metabolite D.

D. Analytical Methods

1. Sugarcane

Residue data on sugarcane were obtained by the method "Determination of Velpar and Metabolite Residues Using Nitrogen Selective Gas Chromatography". The method consists of the measurement of each residue (Velpar, Metabolites A, B, D and E) after reaction with trigluoracetic anhydride. The GLC used was equipped with a nitrogen-phosphorus detector (MRID 0078019).

Adequate recoveries have been obtained in sugarcane at levels as low as 0.04 ppm for Velpar and metabolites A and B, and as low as 0.1 ppm for metabolites D and E. No detectable residues were found in or on sugarcane nor in any of the processed fractions - sugar, molasses or bagasse at recommended application rates.

2. Alfalfa

Residue data on alfalfa forage and hay were obtained by the method "Determination of Hexazinone and Metabolite Residues Using Nitrogen-Selective Gas Chromatography. The residue isolation process of the procedure is divided into two parts. Part I is designed for the moderately polar residues Hexazinone, Metabolites A, B, D and E. Part II is designed for the polar residue, Metabolite C (MRID 0078087).

E. Residue Data

1. Alfalfa

Residue data for green alfalfa forage reflected studies carried out in the States of Arizona, California, Washington, Delaware, New York and New Mexico. Residue data for alfalfa hay were compiled on samples grown only in California and Washington.

At the recommended rates of 0.5 to 1.5 a.i./acre, the following residue data were observed:

Green Alfalfa Forage

PHIs, days	Hexazinone, ppm	Metabolites, ppm A	Metabolites, ppm B and/or E	Metabolites, ppm D
12- 49	<0.04-0.54	<0.04-0.15	<0.1-0.29	<0.1
60- 86	<0.04-0.88	<0.04-0.14	<0.1-0.12	<0.1
102-157	<0.04-0.08	<0.04-0.0	<0.1-	<0.1

Alfalfa hay

PHIs, days	Hexazinone, ppm	Metabolites, ppm A	Metabolites, ppm B and/or E	Metabolites, ppm D
70-79	<0.04	<0.04	<0.2	<0.1
164	<0.04	<0.4-0.1	0.35-0.72	<0.1

Residue data indicate that the levels of hexazinone and its metabolites on green alfalfa forage should not exceed 2.0 ppm for the use on green alfalfa forage.

Residue data on alfalfa hay indicate that the levels of hexazinone and its metabolites should not exceed 8.0 ppm.

2. Sugarcane

Residue studies were conducted in Hawaii, Puerto Rico, Texas, Florida, and Louisiana. The application rates ranged up to the maximum proposed (2 lbs. a.i./acre per application or a total of 4 lbs. a.i./acre per crop cycle for multiple applications). When sugarcane was treated with two applications (1 + 1) or (2 + 2) lbs. a.i./A, <0.04 ppm hexazinone metabolites A or B and <0.1 ppm D or E was found in raw cane, mixed juices or bagasse. In molasses, the reported level for hexazinone and its metabolites was <0.1 ppm (<0.2 ppm for E).

Three residue studies were conducted in Hawaii. The application rates were 5.4 lbs. a.i./acre for one study and 7.2 lbs. a.i./acre for each of the other two studies. The PHI was 7-1/2 to 9-1/2 months. For all three studies, the controls and treated samples showed <0.04 ppm hexazinone, Metabolites D or E in sugarcane, 1st expressed juice, molasses, sugar and bagasse processed fractions.

The data for tank mixes of hexazinone (0.68-0.9 lb. a.i./acre) and diuron (1.2-3.6 lbs. a.i./acre) showed <0.04 ppm hexazinone, Metabolite A or B, <0.1 ppm Metabolite D or E and <0.05 ppm diuron in or on sugarcane. The PHI was 7 months (MRID 0078064).

F. Residues in Meat, Milk, Poultry and Eggs

1. Alfalfa

In a cold cow feeding study, cows were fed hexazinone at levels of 1, 5 and 25 ppm. At the 1 and 5 ppm feeding levels, milk contained no residues of hexazinone and its metabolites which were higher than the controls. At the 25 ppm feeding level, metabolite B was detected at levels of 0.03 to 0.05 ppm in whole milk; the other residues were not found at levels higher then the controls. At all three feeding levels (1, 5 and 25 ppm) no residues of hexazinone and its metabolites, A, B, D, and H were found in the kidney, liver, subcutaneous fat and lean muscle tissues (MRID 0078021).

DuPont submitted a radioactive goat metabolism study. The residue levels of ^{14}C-hexazinone from a 5.0 ppm feeding level were as high as 0.07 ppm (total activity) in milk, 0.01 ppm in fat and muscle, 0.04 ppm in kidney and 0.09 ppm in liver (total activity) (MRID 0078031).

After seven weeks of observation and conditioning to diet, 3 groups of 8 hens each were fed diets containing 0, 1 and 5 ppm hexazinone. After 4 weeks, all birds were sacrificed except four from the 5 ppm group. Those four were fed a conditioning diet for a week and then sacrificed. Composite samples of eggs and feces from each group were obtained weekly, and skin were made of each group after sacrifice. Levels of hexazinone and its metabolies A, B (or E) and D in chickens fed 1 and 5 ppm hexazinone were no higher than control values for eggs, skin, muscle, fat and liver (MRID 0078078).

The maximum feeding level of 5 ppm hexazinone in the diet of poultry showed no detectable residues in eggs, skin, muscle, fat and liver.

2. Sugarcane

Data have demonstrated that no detectable hexazinone residues are expected in sugarcane by-product feed items. Therefore, no secondary residues in milk and meat are anticipated. A livestock feeding restriction on sugarcane forage to livestock must be placed on State labels because of the the lack of data on sugarcane forage.

No detectable hexazinone residues are expected in poultry feed items and no secondary residues are expected (hexazinone and its metabolites A, B, C, D and E) in poultry and eggs.

G. Data Gaps

Presently all data requirements have been filled. Refer to Chapter III, Table 1.

Chapter Eight

Ecological Effects

A. Ecological Effects Profile

1. Technical Hexazinone

Fish

Technical hexazinone is practically non-toxic to warmwater and coldwater fish.

Aquatic Invertebrates

The LD_{50} for *Daphnia magna* is 151.6 ppm after 48 hour of exposure to technical hexazinone with 95% confidence limits of 125.2 and 172.8 ppm.

Estuarine and Marine Organisms

The LC_{50} for eastern oyster embryo larvae is >320<560 ppm after 48 hours of exposure to technical hexazinone. The LC_{50} for grass shrimp is >56<100 ppm after 96 hours of exposure to hexazinone.

Invertebrate Aquatic Life Cycle Studies

The 21-day LC_{50} of *Daphnia magna* is 33.1 mg/k after exposure to technical hexazinone under condition of a 7-day solution renewal. Under conditions of triweekly solution renewal, the 21-day LC_{50} value is <20 mg/l<50 mg/l.

Birds

Technical hexazinone is practically non-toxic to mallard ducks and bobwhite quail.

2. End-Use Products

The soluble powder, pellet, dry flowable and liquid end-use products are practically non-toxic to aquatic invertebrates and exposure to birds and mammals are minimal.

3. Endangered Species Considerations

Sugarcane

According to labeling directions in regards to the use of hexazinone, no endangered species are liable to be adversely affected. The following endangered plant species are found in those states where hexazinone will be applied to control weeds in sugarcane.

State	Species	Location
Florida	Chapman rhodendron	Gulf, Gadsen-Liberty counties
Hawaii	Hawaiian and wild broad bean	7000-8000 foot level on Hawaii
Texas	Texas wild rice	Hays County

None of these three endangered plant species is found in the area of sugarcane fields.

Alfalfa

According to Department of Commerce statistics, many endangered plants are grown in counties where alfalfa is cultivated. For the following plants

1. Aconitum noveboracense - Iowa
2. Coryphantha ramilbasa - Texas
3. Neolloydia moriposensis - Texas
4. Echinocereus viridiflorus var davisii - Texas
5. Coryphantha minima - Texas

it was found that the use of hexazinone would not interfere with the habitats of these endangered plants.

Reforestation Areas:
Hexazinone is toxic to many shallow-rooted plants and may be a hazard to the following plants which are found in areas where exposure is expected

1. Hairy rattleweed (Baptisia arachnifera) - Georgia, Wayne and Brantley Counties

2. Persistent Trillium (Trillium persistens) - Georgia, Rabun and Habersham Counties South Carolina, Oconee County Silvicultural practices at the edge of the Tallulah George

3. Chapman rhododendron (Rhododendron chapmanii) - Florida, Gulf County and Gadsden-Liberty County Lne.

4. Green pitcher plant (Sarracenia oreophila) - Alabama, Cherokee, Dekalb, Jackson and Marshall Counties. Georgia, Towns County.

B. Technical Hexazinone

Fish

1. Bluegill sunfish (hepomis macrochirus)

The 96 hour LC_{50} for bluegill sunfish is 505 ppm (450 - 538 ppm). Ten bluegill sunfish, 3.2 cm standard length were placed in 15 liters of water. Mortality counts and observations were made every 24 hours for a total of 96 hours. Fish were not fed for 48 hours prior to the test nor during exposure. Temperature was maintained at $20^{\circ} \pm 0.2$c. Dissolved oxygen ranged from 5.7 to 9.5 ppm. The pH values ranged from 7.1 to 7.3.

Technical hexazinone is practically non-toxic to warmwater fish. The TL_{50} was calculated by probit analysis.

Technical hexazinone introduced in a static system produced a 96-hour TL_{50} value of >370<420 ppm for bluegill sunfish. The experimental animals were introduced into 5 gallon tanks in groups of 10 per dosage level or control. The fish were allowed to acclimate for 24 hours, prior to the introduction of the test compound in a 25% acetone solution. There were five dosage levels, 160-490 ppm, in addition to a negative control and a positive acetone control. The no effect level was 370 ppm. (MRID 0078056).

2. Fathead Minnow (Pimephales promelas)

The 96 hour TL_{50} for fathead minnow (274 ppm) indicates that technical hexazinone is practically non-toxic to warmwater fish.

Technical hexazinone introduced into a static system produced a 96 hour TL_{50} value of 274 ppm with 95% confidence limits of 207 to 361. The methods and conditions were the same as those described for the bluegill sunfish study. There were six dosage levels, 100-500 ppm. The no effect level was 160 ppm (MRID 0078056).

3. Rainbow trout (Salma gairdner)

The 96 hour TL_{50} indicate that technical hexazinone is practically non-toxic to coldwater fish. The same procedures were used as those used for bluefill sunfish except there were five dosage levels (160-490 ppm). The water bath temperature was 11 (+1.0)C and the average trout body weight was 1.0 g. The no effect level was 240 ppm and the LC_{50} = 320-420 ppm (MRID 0078056).

Aquatic Invertebrates

The 48 hour acute toxicity LD_{50} for Daphnia magna is 151.6 ppm (125.2-172.8 ppm). The 48 hour LC_{50} value under static unaerated test conditions was 151.6 ppm, with 95% confidence limits of 125.2 and 172.8 ppm) (MRID 0078042).

Estuarine and Marine Organisms

Marine toxicity tests (Heitmuller, 1976) were conducted to determine the acute effects of technical hexazinone on embryos of eastern oysters (Crassostrea virginica), on grass shrimp (Palaemonetes pugio), and on fiddler crabs (Uca pugilator). The criterion for effect on oyster embryos was reduction of the number of normal embryos (those which developed to the fully-shelled, straight-hinged veliger state within 48 hours) in test concentrations as compared to the number of normal embryos in the control. The criterion for effect on shrimp and crab was death (MRID 0078018).

Following 48 hours of exposure to technical hexazinone, the LC_{50} for eastern oyster embryo larvae is >320<560 ppm. After 96 hours of exposure of technical hexazinone to grass shrimp the LC_{50} value is >56<100 ppm.

Invertebrate Aquatic Life-Cycle Studies

Daphnia magna were chronically exposed to 95% technical hexazinone in standing dechlorinated-tap water systems with 7-day and triweekly solution renewal conditions. Under conditions of 7-day solution renewal, the 21-day LC_{50} was 33.1 mg/l with 95% confidence limits of 28.1 mg/l and 36.9 mg/l. Reproductive impairment exclusive of adult mortality was not observed at or below 20 mg/l technical hexazinone. Reproduction was low probably as a result of limited nutrient availability caused by the extended duration between solution renewal periods (Schneider 1977, MRID 00780411).

Under conditions of triweekly solution renewal, the 21-day LC_{50} was estimated to be greater than 20 mg/l but less than 50 mg/l. Reproductive impairment exclusive of adult mortality was significant ($p<0.05$) at 20 mg/l technical hexazinone by the LSD procedure but not by Dunnett's procedure. Although technical hexazinone slightly delayed maturation to reproductive stage in daphnids exposed to 5 mg/l and 10 mg/l, the compound did not impair total reproduction at those concentrations. Reproductive success was considerably greater with triweekly than with 7-day solution renewal (Schneider 1977, MRID 00780411).

Birds

Data indicate that technical hexazinone is slightly toxic to upland game birds. Technical hexazinone produced an oral LD_{50} value of 2258 mg/kg with 95% confidence limits of 1628 to 3130 mg/kg. A laboratory test (Fink, 1978) consisted of five control groups in which five bobwhite quail of each sex were tested using five dosage levels, 398-2510. The birds were 20 weeks old and weighed approximately 207g (MRID 0078016).

1. Mallard Ducks

Technical hexazinone is practically non-toxic to mallard ducks. The LC_{50} is estimated to be greater than 10,000 ppm. The dietary LC_{50} for technical hexazinone was greater than 10,000 ppm. The acute dietary LC_{50} of the positive control (Dieldrin) was calculated to be 163.4 ppm (95% confidence limit from 100-242 ppm). Negative controls (Basal diet) were conducted with no deaths (Piccirillo 1978, MRID 0078016).

2. Bobwhite Quail

The LC_{50} value >5,000 ppm, suggests that technical hexazinone is practically non-toxic to bobwhite quail.

Following approximately two weeks of acclimation to laboratory conditions, seventy quail were assigned to 7 groups. One negative control and six dietary levels (156 ppm, 312 ppm, 625 ppm, 1250 ppm, 2500 ppm, 5000 ppm) were established. There were no negative control mortalities. Test results were as follows: one bird from the 1250 ppm level and three birds at the 5000 ppm level calculated the LC_{50} value to be greater than 5000 ppm (Dudeck 1980, MIRD 0078002).

C. Hazard Assessment - End-Use Products

1. Sugarcane

Exposure to hexazinone herbicide in sugarcane fields will be limited to those birds and animals utilizing treated fields for food and/or cover. According to Wildlife Utilization of Croplands by Gusey and Maturgo, animals frequenting sugarcane fields in Florida include deer, rabbit and quail and in Louisiana, nutria and beaver. In Hawaii a variety of birds utilize sugarcane fields as well as three species of rats and the mongoose. Toxicity data for birds and mammals indicate a low hazard to these species.

Indirect exposure to fish and other aquatic organisms may result via runoff and/or drift from target sites. Toxicity data on fish indicate little acute hazard to fish, data on Daphnia suggest that the product is slightly toxic to this organism. Exposure may also occur to shrimp, crab and oysters.

2. Alfalfa

Alfalfa fields provide feed, cover, and nesting for a wide variety of wildlife, such as, pheasants, quail, doves, deer, antelope, and rabbits. The lowest LC_{50} value for birds 1000 ppm for the mallard duck, indicating that the chemical is only "slightly toxic." The lowest value for mammal is the acute oral LD_{50} of 860 mg/kg for the guinea pig. The estimated LC_{50} for the guinea pig would be 50 (860 mg/kg 25% body weight consumed/day) 3449 ppm. Therefore, hexazinone would fall into the "slightly toxic" category. Based on this and the maximum expected residues of 320 ppm on short grass, minimal hazard is expected from the use to birds and mammals.

D. Data Gaps

Presently all data requirements have been filled.

Guide to Use of This Bibliography

1. Content of Bibliography. This bibliography contains citations of all the studies reviewed by EPA in arriving at the positions and conclusions stated elsewhere in this standard. The bibliography is divided into 3 sections: (1) citations that contributed information useful to the review of the chemical and considered to be part of the data base supporting registrations under the standard, (2) citations examined and judged to be inappropriate for use in developing the standard, and (3) standard reference material. Primary sources for studies in this bibliography has been the body of data submitted to EPA and its predecessor agencies in support of past regulatory decisions, and the published technical literature.

2. Units of Entry. The unit of entry in this bibligraphy is called a "study". In the case of published materials, this corresponds closely to an article. In the case of unpublished materials submitted to the agency, the Agency has sought to identify documents at a level parallel to a published article from within the typically larger volumes in which they were submitted. The resulting "studies" generally have a distinct title (or at least a single subject), can stand alone for purpose of review, and can be described with a conventional bibliographic citation. The Agency has attempted also to unite basic documents and commentaries upon them, treating them as a single study.

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   (1) Submission Date. Immediately following the word 'received' appears the date of the earliest known submission.

   (2) Administrative Number. The next element, immediately following the word 'under', is the registration number, experimental permit number, petition number, or other administrative number associated with the earliest known submission.

   (3) Submitter. The third element is the submitter, following the phrase 'submitted by'. When authorship is defaulted to the submitter, this element is omitted.

(4) Volume Identification. The final element in the trailing parenthesis identifies the EPA accession number of the volume in which the original submission of the study appears. The six-digit accession number follows the symbol 'CDL', standing for "Company Data Library". This accession number is in turn followed by an alphabetic suffix which shows the relative position of the study within the volume. For example, within accession number 123456, the first study would be 123456-A; the second, 1234456-B; the 26th, 123456-Z; and the 27th 123456-AA.

Office of Pesticides Programs
Registration Standard Bibliography
Citations to be Considered to be Part
of the Data Base Supporting
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MRID	Citation
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DuPont Confidential Data Appendix

MRID	
0078034	Description of Manufacturing Process for Velpar® 90% Soluble Powder. (Submission received May 8, 1975 under EPA 352-378 Appendix 2. Submitted by E. I. duPont; CDL-124259).
0078058	Confidential Data on Technical Hexazinone (Submission received December 4, 1973 under 352-Exp. 85G. Submitted by E. I. duPont de Nemours; CDL-223386).
0078059	Flammability, Storage and Handling,and Corrosion Tests of Hexazinone. (Letter submitted August 29, 1975 by E. I. duPont; CDL-195110).
0078060	Results of Analyses of DuPont Pesticides for Dimethylnitrosamines (DMV). (Letter submitted December 2, 1976 by E. I. duPont; CDL-230783).
0078061	Confidential Data on Velpar® 10% Pellet Formulation. (Submission received April 1978 under EPA Reg. No. 352-387. Submitted by E. I. duPont; CDL-233401).
0078062	Purity Starting and Intermediate Materials Used in Velpar® Technical Manufacturing Process in Support of the 10% Pellet Formulation. (Submission received May 22, 1978 by E. I. duPont; CDL-233990-A).
0078063	Acclerated Storage Study for the 60% Dry Flowable Formulation. (Submission received June 7, 1978 under EPA Reg. No. 352-388. Submitted by E. I. duPont; CDL-234059).
0078063	Particle Size Information for the 60% Dry Flowable. (Submission received June 7, 1978 under EPA Reg. No. 352-388. Submitted by E. I. duPont; CDL-234059).

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0078076 Toxicity Tabulation - Hexazinone Via Multiple Routes of Exposure. (Submission received June 7, 1978 under EPA Reg. No. 352-388. Submitted by E. I. duPont; CDL-234058).

078088 Determination of Hexazinone Metabolite C. (Submission received January 18, 1980 under Pesticide Petition 8F2219 (Sugarcane). Submitted by E. I. duPont).

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0078090 Impurity Profile - Velpar^{R} 90% Soluble Powder: Fourth Periodic Report 352-EUP-91 on Sugarcane. (Submission received December 8, 1977 under 352 EUP-91. Submitted by E. I. duPont).